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E. A. PEEL

H. J. HALLWORTH

A. M. WILKINSON

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INSTITUTE OF EDUCATION
UNIVERSITY OF BIRMINGHAM

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W. J. S.
1906 - 1965

Wilfred James Sparrow was born at Ibstock, Leicester, the son of Alderman J. J. Sparrow, and was educated at Dixie Grammar School Market Bosworth and King Edward VII Grammar School, Coalville. He left school at thirteen and worked at a colliery for over two years, before returning to school. Later he graduated with first-class honours in Physics at the University of Birmingham.

He had twelve years' experience as a schoolmaster, first at St. Philip's Grammar School, Edgbaston (1929-35) and then as senior physics master at Saltley Grammar School (1936-41). In 1931 he married Catherine Mary Hatfield.

From 1941 to 1947 he was on the staff of Loughborough College, and for the last two years of that time was deputy head of the department for training teachers.

In 1948 W. J. S. was appointed a lecturer and rapidly became Deputy for Post-graduate Training in the Department of Education at the University of Birmingham. The Institute of Education had not long been established, and the work of the Institute and Department was rapidly expanding. Dr Sparrow undertook most of the administrative work of the Education Department, and gave invaluable and devoted service to Education, and to the University, until his death. Although gravely handicapped by painful illness for the last few years, he never allowed his own troubles to diminish his labours, dim his vision, or cloud his judgment.

Administration, to him, was no impersonal business. We all, students and staff alike, learnt to love him, and trust his wisdom. He held us together, as perhaps no-one else could have done; and no-one who went to him for help ever came away empty.

He was much more than a departmental administrator. His influence, in matters of policy, was felt—often decisively—in the affairs of the Institute of Education, through the University (he was for a time a member of Senate), and further afield. He was a member of the governing bodies of St. Philip's Grammar School, King Edward's School, Stourbridge, the County of Stafford Training College, and the Council of the Selly Oak Colleges. He was Chairman of the Mid-

land Branch of the Science Masters' Association, 1954-58, and a member of the West Midlands Committee of the British Association.

He was a teacher and scholar of distinction. Few men in our generation have so catholic a range of knowledge and interests. Trained as a physical scientist, and author of a standard book on Heat, he became interested in the history of science. It was in the latter field that he gained his doctorate. His most important publication, *Knight of the White Eagle*, is a most interesting and also scholarly biography of Sir Benjamin Thompson, Count Rumford. The work establishes Dr Sparrow beyond doubt not only as a skilful biographer, but as an authority on the history of science.

His wider intellectual interests included philosophy and theology, in which fields he was well equipped. He was a musician. And he knew a great deal about architecture—especially church architecture.

He worked always for the religious life of the University; and the mid-week service which he began and maintained at Edmund Street has become part of the regular programme of St. Francis Hall. He served on the Committee of St. Francis Hall, and was a member of the Diocesan Council for Religious Education.

Above all else was his quality as a person—his unfailing courtesy, his courage in adversity, his self-discipline, his patience, his selflessness, and his true humility. Whether in the University, or in his home where his wife and he gave so many of us their hospitality, he was there to share his serenity, his vision, his shrewdness, his humour, and his good company.

We who knew him are deeply thankful for his friendship and his example. He cared for others, like his Master, the Good Shepherd.

There are some, faithfully working *in* the world, though not being *of* the world, whom the world does not know rightly how to honour. Their true memorial is in the quiet places of the heart.

M. V. C. JEFFREYS

AN EMPIRICAL STUDY OF THE CONCEPT OF RETARDATION

by W. CURR and H. J. HALLWORTH
Department of Education, University of Birmingham

SUMMARY

IN order to make an empirical study of the concept of retardation, complete age groups of nine-year-old and thirteen-year-old children in an industrial borough were given tests of reading and non-verbal ability. Further psychological and sociological measures were obtained for each child. Three indices of backwardness in reading were calculated using the "difference", "ratio" and "prediction" methods; the "prediction" method was also used to calculate backwardness in non-verbal ability. For each group a correlation matrix was obtained for all measures, and five principal components were extracted. These were rotated in accordance with the Varimax criterion. The five Varimax factors had comparable loadings across the two analyses. The first is identified as a factor of backwardness, and the second as a factor of "retardation measures". Following an examination of the loadings on these factors it is concluded that the concept of backwardness is further substantiated, whilst the concept of retardation is not shown to be anything more than a statistical artefact.

The remaining three Varimax factors are also discussed.

I. INTRODUCTION

Recent controversies concerning backwardness and retardation have indicated the need of further empirical evidence to establish the concept of retardation or underfunctioning. The arguments about the nature of retardation have been summarised by Phillips (1961) and it would now be generally agreed that there are certain correlations between retardation scores and the measures from which they are derived which follow logically and necessarily from the methods by which the retardation scores are obtained.

It would also be generally agreed that retardation should be measured by the "prediction" method: that, for example, retardation

in reading should be assessed by obtaining a difference between observed reading test score, and reading score as predicted from an intelligence test score on the basis of a known correlation between the two tests. Levy (1962) has offered a theoretical justification of this procedure. If the concept of retardation is retained, the only reason which might now be adduced by psychologists for not employing the prediction method is that, in clinical practice, there are some situations in which the method is simply not practicable.

The concept of "retardation", however, still requires empirical substantiation. "Backwardness" has long been known to be associated with a number of variables which are of educational and social import, such as social class, family size, general and mental health, regularity of school attendance (Burt, 1952). Retardation has not been shown to be related to any such variables and the value of the concept has been constantly disputed (e.g. Vernon, 1958, and Phillips, 1958). Hypotheses have been offered but have not been substantiated in the statistical sense. The present article reports an investigation in which an effort was made to obtain such substantiation.

2. DESIGN OF THE RESEARCH

The subjects of the research were two complete age groups of children in an industrial borough in the Midlands: all nine-year-olds and all thirteen-year-olds. Each child was given a test of reading ability and a non-verbal test as follows:

1. Junior schools: N.F.E.R. Sentence Reading Test 1, Non-verbal Test 5.
2. Secondary schools: N.F.E.R. Sentence Reading Test 6, Non-verbal Test 3.

These tests were given by teachers in their own schools on a school morning other than Monday or Friday, and for the most part on the same day in every school. Absentees were tested within a period of eight weeks after the original test.

Further information was obtained which was assumed to bear a potential relationship to backwardness or retardation, as follows:

1. Family size and ordinal position in family.
2. Regularity of attendance, rated by teachers on a 3-point scale.
3. Health, rated by teachers on a 5-point scale.
4. Specific defects of hearing, speech, eyesight; and special defects such as spastic paralysis, asthma and deformities. Precise information relating to these categories was supplied by the

Medical Officer of Health. Teachers indicated cases in which the child was considered to be suffering from overtiredness, possibly as a result of watching too much television, for example.

5. A rough measure of mental health was obtained by indicating if the child had been referred to the Medical Officer of Health, an educational psychologist or a child guidance clinic.
6. A measure of general personality was provided by the class teacher's rating of each child on a 5-point scale. In effect, this was a measure on the emotional stability dimension (Burt, 1948; also Hallworth, 1964).
7. Parental occupation was obtained and was converted to a social class rating according to a modified version of the Registrar-General's classification of occupations. Social classes 1 and 2 were amalgamated to form one "professional" class, and social class 3 was sub-divided into clerical and skilled manual occupations. This gave a 5-point scale.
8. Teachers rated the amount of parental encouragement given to the child, on a 3-point scale.
9. Finally, for the nine-year-old age group only, the number of terms of infant schooling was indicated since it was considered that children with longer schooling might possibly show less backwardness and retardation.

Complete information was obtained for 737 children in the nine-year-old group and for 703 children in the thirteen-year-old group. Three children were omitted from the younger age group, twelve from the older age group.

3. STATISTICAL ANALYSIS

Since the original standardisation of both the reading and the non-verbal tests which were used, mean scores had increased throughout the country as a whole. It was therefore necessary to re-standardise and calculate appropriate age-allowances for both sets of tests for the sample of children involved in this research. Only standardised test scores were used in the analysis.

For each age group, correlations were calculated between reading and non-verbal scores and were used to obtain, for each child, a reading score predicted from non-verbal score, and a non-verbal score predicted from reading score. Three criteria of retardation were then used, to give three retardation scores for each subject. The "differ-

ence" retardation score was obtained by subtracting non-verbal from reading scores and adding 100. The "ratio" retardation score was obtained by dividing reading by non-verbal score and multiplying by 100. Finally the "prediction" retardation score was obtained by subtracting predicted reading score from observed reading score and adding 100. It will be noted that these three indices are, in effect, indices not of retardation, but of "forwardness".

In order to take full advantage of the available data, a prediction criterion of forwardness in non-verbal ability was also obtained by subtracting predicted non-verbal score from observed non-verbal score and adding 100. No attempt was made to include the measure of retardation developed by Levy because, in effect, such scores would correlate almost perfectly with the scores obtained by the prediction method of assessing retardation.

Including the sex variable, this gave a total of 26 measures for the younger age group and 25 for the older age group, as shown in Table I. Using an electronic computer*, two correlation matrices were obtained for all variables, one matrix for each age group. Each matrix was then analysed by the method of principal components, five components being extracted which accounted for 55% of the variance in the younger age group and 56.5% of the variance in the older age group. Finally, the axes were rotated in accordance with the Varimax criterion to obtain an approximation to simple structure. In the two present instances it so happened that there was comparatively little difference between the original components and the Varimax factors. Only the Varimax factors are therefore given in Table I.

4. RESULTS

For each of the two analyses the first two factors account together for approximately one-third of the total variance, and apportion this amount almost equally. Further, they are essentially identical factors in the two groups. A third factor in each analysis accounts for just over 7% of the variance and is again comparable in its loading for each age group. A fourth factor is also comparable and extracts approximately the same amount of variance in each case. The fifth factor again extracts approximately the same amount of variance in both analyses, but has somewhat different loadings due, apparently, to the inclusion of the extra variable in the analysis for the nine-year-old group.

* The computer programmes were written in Mercury Autocode and machine code by H. J. Hallworth.

TABLE I

LOADINGS ON FIVE VARIMAX FACTORS FOR JUNIOR AND SECONDARY SCHOOL CHILDREN

Variable	Junior					Secondary				
	I	II	III	IV	V	I	II	III	IV	V
1. Sex (1 = girl, 2 = boy)	-06	05	13	-24	10	-01	20	-02	-16	18
2. Reading score	78	56	-11	-03	-11	91	32	-14	-13	-10
3. N.V. score	91	-31	-11	-01	-12	83	-49	-12	-14	-10
4. Difference criterion	-09	99	-01	-01	00	11	99	-03	02	-01
5. Ratio criterion	-12	98	00	03	-01	10	99	-03	03	00
6. Predicted reading score	91	-31	-11	-01	-12	83	-49	-12	-14	-10
7. Predicted N.V. score	78	56	-11	-03	-11	91	32	-15	-13	-11
8. Prediction criterion	28	95	-05	-02	-05	47	87	-09	-04	-05
9. Prediction criterion, N.V.	51	-80	-04	-02	-05	28	-95	-03	-07	-04
10. Age	-17	-04	-16	-03	-46	-11	04	10	-48	06
11. Late ordinal position	-13	-02	85	-09	08	-06	-01	86	-08	-01
12. Large family size	-19	-04	88	-02	06	-15	-04	89	-03	00
13. Poor attendance	-12	-06	03	80	-05	-18	-06	37	61	02
14. Poor health	-22	-08	09	83	05	-20	-05	33	69	07
15. Hearing defects	-05	-03	07	-10	-11	-09	-03	-05	05	05
16. Speech defects	-14	-02	14	-02	32	-09	02	-18	25	18
17. Sight defects	-12	-15	-07	02	10	20	-02	11	19	26
18. Other defects	06	-01	10	48	24	-04	09	-06	37	-08
19. Overtiredness	-06	00	29	16	-06	-04	00	19	11	-03
20. M.O.H.	-26	-06	-08	00	59	-21	03	-13	04	69
21. Educ. Psychologist	-21	-11	-14	-01	53	05	-01	02	-03	76
22. Child Guid. Clinic	-13	03	-14	-06	52	-03	02	-02	-06	63
23. Poor personality rtg.	-47	03	04	34	25	-23	-01	14	58	12
24. Low social class	-36	-01	31	-05	02	-44	-04	18	01	-12
25. Little parental encouragement	-56	-08	31	11	02	-40	-06	48	23	-04
26. No. of terms in infant school	-07	04	-14	-15	-64	-	-	-	-	-
Percentage of Total Variance	16.36	16.84	7.63	7.10	7.10	15.93	17.44	9.08	7.34	6.71

Where necessary the high scoring end of the scale for each variable is indicated; except for variables 15-22 inclusive, in which children with most "defects" obtain the highest score.

Factor I: Concomitants of High Test Scores

Factor I extracts 16.36% of the variance in the junior analysis and 15.93% in the secondary and may be labelled "high test scores and their concomitants". It is, in effect, the obverse of backwardness and its associated variables. High loadings are as follows:

Variables	9-year-olds	13-year-olds
2 Reading score	.78	.91
3 N.V. score	.91	.83
6 Predicted reading score	.91	.83
7 Predicted N.V. score	.78	.91

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The highest loadings are for reading score (2) and non-verbal score (3), and for the associated reading score predicted from non-verbal score (6) and non-verbal score predicted from reading score (7). Predicted scores are necessarily correlated with the variables from which they are calculated, as also are the prediction criteria of retardation in both reading (8) and non-verbal score (9). These latter variables have somewhat lower but still consistent weightings on this factor.

There is one interesting point of difference between the two analyses. For the nine-year-old group, the greatest loadings are on the non-verbal score (3), and on the reading score predicted from the non-verbal score (6); and the non-verbal retardation loading (9) is greater than the reading retardation loading (8). The opposite relationship holds for these variables in the analysis for thirteen-year-olds. This is, of course, no more than an indication that for the younger children a greater total variance may be extracted from all variables by considering their correlations with non-verbal rather than with reading scores, whereas the opposite is true for the older children. This effect could be produced by the relatively greater concentration on reading in the junior schools, with a resultant levelling up of attainment, leaving non-verbal ability with a more significant relationship to other variables measured in this research. Strictly, Factor I in the analysis for nine-year-olds is a factor of non-verbal ability and its concomitants; whereas the same factor for thirteen-year-olds is a factor of reading ability and its concomitants.

The remaining variables, with two exceptions, have negative loadings on Factor I in each analysis. This is essentially what was predicted, namely, the association of backwardness with certain adverse environmental and personal conditions. In particular, higher social class (24), greater parental encouragement (25) and teacher's assessment of stability (23) are associated with higher reading and non-verbal scores. Children who have not been referred to the Medical Officer of Health for reasons of mental health (20), and whose attendance (13) and general health (14) are good, also have higher scores. Other variables having consistent associations with higher reading and non-verbal scores are early ordinal position in the family (11), smaller family size (12), freedom from hearing defects (15), and speech defects (16), and from excessive tiredness (19), and no referral to the child guidance clinic on grounds of mental health (22). In effect, the loadings indicate a factor which represents the syndrome of backwardness which has already been well defined. Burt has given a full account of the syndrome and numerous other writers have indi-

cated the relationship between intelligence and attainment on the one hand, and social class, family size and ordinal position in family on the other.

Measures derived from teachers' ratings, such as stable personality (23), have been discussed elsewhere in relation to teachers' perceptions of their pupils (Hallworth, 1962).

The low but consistent negative loading of higher chronological age (10) suggests merely that too great an age allowance was made in the re-standardisation of the two tests.

Factor II: Retardation Measures

Factor II, which extracts the greatest amount of variance for each analysis (16.84% and 17.44%), is the crucial factor in relation to the concept of "retardation". High loadings are as follows:

<i>Variable</i>	<i>9-year-olds</i>	<i>13-year-olds</i>
4 Difference criterion	.99	.99
5 Ratio criterion	.99	.99
8 Prediction criterion	.95	.87
9 Prediction criterion, N.V. score	-.80	-.95
2 Reading score	.56	.32
3 N.V. score	-.31	-.49
6 Predicted reading score	-.31	-.49
7 Predicted N.V. score	.56	.32

The factor may be identified as a factor of "retardation measures", and the loadings are precisely those that would be predicted from arguments regarding the statistical relationship between such measures, and their relationship to the scores from which they are derived. As already noted, our measures are of "forwardness". It is seen that all measures of "forwardness" in reading (variables 4, 5 and 8) have high loadings; and the observed reading scores (variable 2) from which they are obtained have loadings in the same direction, but somewhat lower, as would be expected. Similarly, the measures of "forwardness" in non-verbal scores (9), and the observed non-verbal scores (3) have loadings in the same direction, the latter again being the lower of the two. The same loadings are obtained for reading score predicted from non-verbal score (6) as for non-verbal score (3); and for non-verbal score predicted from reading score (7) as for reading score (2). These loadings are all functions of the relationships which necessarily exist between the respective variables owing to the manner in which the derived scores are obtained.

The remaining variables, 10 to 26 inclusive, are those which are of

special interest in relation to the retardation measures. Although there is in fact a preponderance of negative loadings, especially in the analysis for nine-year-olds, they are almost uniformly insignificant. The general conclusion is that no syndrome of "retardation" has been obtained.

Factor III: Family Size and Parental Attitude

The third Varimax factor extracts only 7.63% of the variance in the analysis for nine-year-olds and 9.08% in the analysis for thirteen-year-olds. Highest loadings are as follows:

<i>Variable</i>	<i>9-year-olds</i>	<i>13-year-olds</i>
12 Large family size	.88	.89
11 Late ordinal position in family	.85	.86
25 Little parental encouragement	.31	.48

This factor indicates a relationship between large family size (12) and late ordinal position in family (11), which are necessarily correlated owing to the method of measurement used, and less parental encouragement (25). Low social class (24) has a small loading on this factor in the analysis for younger pupils, and a still smaller but consistent loading in the analysis for older pupils. In the former analysis excessive tiredness (19) has a small loading; and in the latter, attendance (13) and general health (14) have smaller loadings. The factor indicates an association between family size and parental attitude and, in less degree, the other variables mentioned. This is entirely as expected.

Factor IV: Attendance and Health

Factor IV extracts just over 7% of the variance in each analysis and in each case has its high loadings as follows:

<i>Variable</i>	<i>9-year-olds</i>	<i>13-year-olds</i>
14 General health	.83	.69
13 Attendance	.80	.61
23 Personality	.34	.58
18 Miscellaneous physical defects	.48	.37
10 Age in months	-.03	-.48
1 Sex	-.24	-.16

This is a factor of good health, attendance, stable personality and freedom from miscellaneous physical defects such as spastic paralysis, asthma, deformities, etc. It is of interest to note that, in accordance with expectation (Tanner, 1961), there is a slight tendency for girls to have better health etc., than boys.

Factor V: Mental Health

Factor V extracts approximately 7% of the variance from each analysis and is primarily a factor of mental health. High loadings are:

<i>Variable</i>	<i>9-year-olds</i>	<i>13-year-olds</i>
20 Referral to school Medical Officer	·59	·69
21 Referral to Educational Psychologist	·53	·76
22 Referral to Child Guidance Clinic	·52	·63

The small but consistent loadings in both analyses on reading score (2) and non-verbal score (3), predicted reading score (6) and predicted non-verbal score (7), suggest that here is a small backwardness syndrome again, related this time specifically to mental health. Such a syndrome has frequently been hypothesised, but it is notable that the measures of retardation (4, 5, 8 and 9), have virtually zero loadings on this factor. Thus again it is backwardness, not "under-functioning", which shows a link with mental health.

There are small but consistent loadings on speech defects (16), and small loadings (in the junior analysis) on miscellaneous defects (18) and (in the secondary analysis) on defective eyesight (17) which suggest other elements in this syndrome. The consistent loading on variable 23 indicates a low stability rating by teachers, and may reflect either a personality trait or a facet of teachers' perceptions.

Two loadings in the junior analysis are of special interest but of debatable interpretation. These are high chronological age (10) and length of attendance at the infant school (26). These two variables are necessarily correlated, since children older in their age group start school earlier in the year than do the younger children, and therefore have more terms in infant school. It would not, however, be expected that the former children would have a tendency to better mental health. An obvious interpretation is that since the older children have more terms in the infant school and tend to be further developed both physically and mentally, they are more likely to make a satisfactory personal and social adjustment. The factor requires further substantiation, however, before it need bear detailed interpretation. It is to be remarked that, in the secondary analysis, chronological age (10) has a zero loading on this factor suggesting, that either the high loading in the junior analysis is a chance finding, or that the effect disappears as the children grow older.

5. CONCLUSION

The two analyses have comparable factors which may readily be interpreted and which are, for the most part, in accordance with predicted relationships between the variables used. In particular, a factor of reading and non-verbal scores and their concomitants was obtained, and was seen to be a generalisation of the backwardness syndrome so frequently identified in earlier work.

The various measures of retardation also gave a factor which was predicted from a consideration of the statistical relationships between such measures. However, no other variables, either psychological or sociological, had significant or consistent loadings on this factor. In other words, there was no evidence that the concept of retardation, however defined, has meaning in terms of the measures used in this investigation. If the concept is no more than a statistical artefact, bearing no relation to those psychological and sociological measures which are, for example, associated with educational success or backwardness, it is questionable whether it is worth retaining.

This research does not, however, provide evidence that retardation is a mere statistical artefact: it merely fails to provide evidence that it is anything more. Where this research has failed, others may succeed. It may be possible to obtain finer measures than were used in the present case, or to obtain other measures which may have greater relevance to retardation. It is of some importance, however, that an attempt to provide psychological and sociological substance to a concept of backwardness and retardation succeeded with the former and failed with the latter. The indications are that retardation is at least a more tenuous concept than backwardness, and of less certain value. Its relevance has still to be demonstrated statistically.

Finally, it may be noted that it makes little difference whether we speak of retardation in reading as compared with non-verbal ability, or retardation in non-verbal ability as compared with reading. In each case we have an empirical demonstration of necessary statistical relationships. The two measures of retardation are related and lie on one factor; the former is still strenuously debated, the latter is universally regarded as meaningless, but the evidence here obtained suggests that there is no reason to regard one as more meaningful than the other.

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THE NATURE OF ABILITY IN ENGLISH COMPOSITION

by E. PERCIVAL
Boteler Grammar School, Warrington

I. COMPOSITION SCALES

FROM the beginning of the organised study of education, much attention has been given to the many complex problems which surround and emerge from the marking and assessment of English composition work. With the expansion of a system of public examinations on which much depended, these problems became acute and took up much of the attention and energies of educational psychologists and research workers. During the past fifteen years, the public has become aware of the difficulties of assessing compositions from the inclusion of such work in some 11 + selection procedures. In the future, the difficulties will probably arise from the examinations held for the award of the Certificate of Secondary Education. Here, however, the situation may well be aggravated by the need for far more markers than were involved in 11 + selection, with the resulting discrepancies arising from reliability and validity. To-day, examining bodies for the General Certificate of Education qualify as front-page news on these very same counts. These notes are offered in anticipation of future problems and in the hope that they may suggest profitable lines of inquiry. Indeed, the suggestions here made may well be more relevant to the Certificate of Secondary Education than to the General Certificate of Education, as will be obvious in due course.

Up to now little attention has been given to the production and consequently to the use of quality scales of English composition. Such a scale offers samples of varying degrees of proficiency in English composition work and the marker tries to match the scripts being marked with the samples of the scale and thus arrive at some assessment of merit. In the modern search for objective tests, this scale is the nearest we have arrived at for composition work. The reasons for the neglect of this line of inquiry are obvious. The marker must be intimately familiar with the scale he is using, and this is a time-consuming and exacting task. The production of such a scale is

in itself a slow and laborious piece of work, added to which is the fact that such scales seem to receive little encouragement from the educational scene generally. Again the scripts must be based on a subject for which the scale has been produced and the scarcity of such scales is very restricting. Indeed very few composition standardised for Britain have been produced. The best known are those of Burt, Boyd, Williams, and Schonell. Other collections of composition work have been published by Steel and Talman and under the chairmanship of Hartog.

But perhaps the greatest factor militating against the use of such scales as are available arises from the difficulty of applying a scale. Armed with only the examples themselves, a marker may experience serious difficulties and doubts in matching up scripts with samples, even when he has mastered the scale. The argument is here put forward that such a marker would be greatly helped if he had at his disposal information concerning the nature of ability in composition, and it is fortunate that such information may be gained from the processes which lead to the production of composition scales.

The selection of the samples for a quality scale is not an arbitrary matter and one method of selection produces much information about the nature of the composition ability which is not openly evident in the published scale, but which can be of great help to a marker, whether he is using a scale or not. The object here is to describe those features which together constitute skill in English composition and to show the extent to which they are found in a representative sample of an age group.

These observations are based on information gained from the construction of a quality scale of English composition (Percival, 1958) which was based on the work of a complete 11+ age group of an English county borough (644 boys and 680 girls). The scale in its final form gave fifteen samples of composition for boys and the same number for girls, arranged in descending order of merit on a fifteen point scale. I.Q.s (on Moray House Tests) were available (among other measures which do not here concern us) for the whole group, so that it is possible to present the measures of the elements of the compositions as they appear in intervals of I.Q. from 140-140+ to 70-74. The composition test consisted of a sequence of four pictures which depicted two children taking part in an adventure. The candidates were asked to tell the story and to finish it in their own way. Thus the test called for skills in writing description, narrative including characterisation, dialogue, and the imaginative power to complete the story.

The task was both reproductive of experience and creative in an original way. Approximately half-an-hour was allowed for the test. The composition scripts were examined and analysed and it is to certain of the analyses that we now turn. It will be noted that the measures being described are of an objective or near objective nature.

2. MEASURES EMPLOYED

Number of Words

The easiest of such measures to arrive at is the amount produced in a given period, in terms of the number of relevant words written. This is the point from which most earlier workers in this field began. Now it is clear that mere bulk alone is no absolute guide to composition ability, but it is also clear that without it a composition does not exist. It is only too easy to lose sight of the fact that at its simplest level ability in composition lies in the putting together of words and that a measure of the writer's skill may be seen in the way in which he selects and arranges his words; this is his act of composing his words. Without a certain bulk in words it is impossible to judge competence in composing in words. But how many words may a marker reasonably expect? Here a composition scale, discriminating as it does between the ages and natural abilities of writers, is able to provide a useful guide and so enables the marker to leave the world of guesswork and return to reality. A count was made of the length in words of each composition and the results were grouped according to the writer's I.Q.s. In this count was found, for both boys and girls, a steady rise in production with rise in I.Q. interval. Individuals in the lowest group occasionally produced nothing at all, although the average number for these boys was 77, and for these girls 66. In the highest I.Q. interval, the average number of words written by boys was 239, and by girls 276. For the whole test population, the average number of words written was 163 for boys and 198 for girls. Average numbers of words written were calculated for each I.Q. interval, so that a scale for the complete population was available. Thus a marker has immediately a crude but rapidly gained idea of where a given script fitted into the whole age group. Such a measure could be applied quite easily to an isolated script.

Sentences

The number of words written is, of course, a very rough indication of ability, though it is perhaps more telling at 11+ than at, say 16+. Far more important are the ways in which those words are

arranged, presented, and selected, and we turn now to those aspects of composition work. After bulk has been considered, the next obvious measure to be considered is the arrangements of those words in their simplest units, i.e. in sentences. Now the length of a sentence, also, is clearly no absolute measure of composition ability. There will be moments in literary composition when brevity of expression is required (e.g. the approach to a moment of climax in narrative, the stages of an argument). But it is also true that, if a sentence is regarded as a thought unit, the repeated use of the very short sentence will restrict a writer's ability to convey complexity of motivation or of developing thought or theme. Burt puts the point thus:

... the sentence tends to expand with an increase of ability or with an advance in age. ... With children, indeed, length of sentence forms a good index of the span of verbal synthesis—that is, the power to organise thoughts in units of high complexity, and to formulate those units in words. It is, in consequence, a rough measure of literary ability; the longer the sentence, the abler the writer (p. 359).

At the 11+ age group the length of sentence tends to be of greater use than it would be at 16+, for in literary matters the younger child tends to be less sophisticated. In this 11+ age group, it was found that the ability to write long sentences tended to grow with the increase of I.Q. At the highest intellectual level, the average number of words in a sentence was, for boys, 13 and for girls 12. In the lowest intellectual range these numbers became 8 words for both boys and girls. For the group as a whole the average length of a sentence, for both boys and girls, was 10 words. Averages were obtained for each interval of I.Q. with the result that the marker had at his disposal another rough but suggestive measure of ability in composition.

Co-ordinating Conjunctions

The longer the sentence, however, the more the writer is grouping his ideas as he sees them related, and in the skill by which these relationships are shown we have another measure of literary ability. Insofar as ideas are expressed in sentences or clauses, the writer will have to use conjunctions, for the function of these words is to show how two or more concepts or ideas are related. Indeed, the ability to deal with the complexity of ideas and to order them in a satisfactory manner will be reflected in the writer's skill in selecting his conjunctions. Burt (p. 359) has shown that conjunctions tend to appear in a given order which is determined by the writer's intellectual development and by the simplicity or complexity of the conjunction concerned.

In its most elementary form, English composition work tends to consist of simple sentences, i.e. conjunctions are not used at all. One idea follows another in isolation; the writer gives no explicit indication of how they are related, although the relationship may by implication be obvious enough to the reader. The first conjunctions to appear are co-ordinating in function, i.e. they make little or no distinction between the relative importance of ideas. Of these the commonest is "and", the use of which produces sentences which show a sequence of events but gives no idea of the subtle inter relationship of cause and effect. Such conjunctions appeared, correctly used, at all I.Q. intervals. At the lowest intellectual level, 59% of boys and 61% of girls used them. From I.Q. group 85-89 upwards, not less than 90% of each interval used this kind of conjunction correctly. Of the test population as a whole, this kind of conjunction was found in the work of 91% of the boys and 93% of the girls.

Subordinating Conjunction

The correct use of a subordinating conjunction, however, is a very different matter, for it shows a writer's ability to discriminate between the importance of two or more events or ideas and to arrange them accordingly in a sentence. Of these conjunctions, those of a temporal kind, i.e. those which express a time relationship ("when", "as") were the commonest. From I.Q. 80-84 onwards, they were used by more than half of each I.Q. group of both boys and girls. Of the whole test population, they were used by 78% of the boys and 84% of the girls. But after this relatively simple relationship, the use of the remainder of the subordinating conjunctions fell markedly. The use of a relative conjunction (i.e. one which made a deliberate joining of a substantive and a limitation) barely existed before I.Q. group 90-94. It was most frequent in the highest intellectual group. Of the whole population it was used by 31% of the boys and 34% of all girls. Conjunctions of reason ("because", "since", "as") were used by 27% of all boys and by 32% of all girls. The ability to put together ideas on a basis of contingency ("if", "unless") was even rarer—15% of all boys and 23% of all girls. Other kinds of subordinating conjunctions hardly appeared at all.

Punctuation

The mass of words must not only be arranged in units of sentences: it must also be presented in accordance with the principles of punctuation which is a conventionally accepted system, involving the

use of marks, capital letters, and certain arrangements. Punctuation contributes largely to the speed by which a passage may be read and understood. Here, again, ability in the correct use of punctuation tended to deteriorate with the decline of I.Q. The greatest number of different functions of punctuation marks correctly used was 11; certain scripts showed no ability to arrange material according to the accepted standards at all. The commonest feature was the beginning and ending of a sentence (capital letter—full stop) which was used by all except the lowest I.Q. ranges (from I.Q. 80-84 downwards). Also high in incidence was the use of a capital letter to denote a proper noun (no group with less than 40% of its members using this), and the use of the capital for the personal pronoun "I". Each of these marks was used by more than half of the entire group, both boys and girls. The use of the apostrophe to indicate an omitted letter or letters was found in almost half the scripts. The remainder of the punctuation marks were used by small minorities, as the following list shows:

	boys	girls
comma for pause	41%	44%
apposition	4%	7%
dash	1%	4%
question mark	16%	14%
exclamation mark	25%	21%
semi-colon	3%	7%
possession	7%	8%
speech	27%	34%

Boys used on an average 4 different functions of punctuation and girls averaged 5.

Paragraphs

It is customary to arrange sentences in paragraphs and accordingly a record was made of those who arranged their material in this way. Of the whole group only 18% of the boys and 19% of the girls arranged their material in this way. Clearly the use of the paragraph is not a normal feature in the composition work of an 11+ age group.

Unity of Structure

But if the formal arrangement of material into paragraphs is missing, the composition in themselves might nevertheless show a unity in organising the compositions. Since the candidates were reproducing and continuing a piece of narrative, it seemed reasonable to ask whether the scripts showed a recognisable beginning, middle,

and an end, i.e. whether they had a unity of structure. Of the whole group, 57% of the boys and 63% of the girls showed the ability to arrange material in this way.

Stylistic Features

So far we have considered the arrangement of the words which constituted the compositions. We turn now to consider the way in which the words showed a sense of selection, for the quality of a composition will lie in the writer's ability to select the words most appropriate to his purpose, not only in the production of intellectual and logical material, but also in the conveying of atmosphere, emotions and sensory experiences. At this point a study was made of the vocabulary used in the scripts. Any such examination will of necessity be an involved process and for our present purpose a simplified and brief account of the measures will be given. A note was made of the following stylistic features:

accuracy of choice of words—the writer showed discrimination in choosing words which conveyed a more accurate sense of the occasion than more usual everyday words would have done, e.g. "to hurry", "to prance", "to dash", "to trot", for generalised words such as "to come" and "to go":

words with sensory appeal

"moaned", "gurgled", "wheezed";
 "prancing", "stumbled", "groped", "grasped", "pelting",
 "gnawed";
 "the jagged cliffs", "the dim light", "in the gloom";

the effective use of literary devices—most of which are based on a comparison

"trussed up like geese", "to take stock of",
 "poured out their story", "caught red handed",
 "angry voices";

effective use of associated words or phrases—usually producing a motor sensory effect

"struggled, pulled and pushed", "tugging and pulling".

It is immediately obvious that these categories are by no means watertight, but this did not matter since an example was recorded only once under this section. This concept of "effective language" was largely derived from the work of Steel and Talman who discuss the matter

fully. Of the whole test population, it was found that the number of examples of effective language ranged on the average from 7 for both boys and girls of the highest intellectual level to no examples at the lowest. The figures for the group as a whole were 2 examples for boys and 3 for girls.

3. IMPLICATIONS DISCUSSION

The construction of a composition scale has thus provided measures of essential literary skills relatively objective in nature. Clearly there are other elements in composition ability, but they tend to be among the great imponderables and are therefore outside the scope of this article. It is here argued that a marker may be considerably helped if he has at his disposal norms of performance which will indicate where in a continuous scale of ability any one script might fall. It is not, of course, being suggested that the marker should spend his time counting words, phrases, or punctuation marks (although stranger and less profitable methods have been used in the name of composition assessing). These measures are intended to be directive and suggestive rather than restrictive. It is also hoped that a marker might read a script actively looking out for these elements, though not deliberately recording them. Indeed, looking for them might be of great help to the confirmed "general impression" markers. Usually three measures only have been quoted—the average and the two extremes, but it should be remembered that there would be available many more indicating the increasing element being considered. It should also be remembered that these norms apply fundamentally to an 11+ age group and that different norms would be required for different age groups. This is particularly important at 16+, by which time the composition work has become more complex, subtle, and sophisticated. Indeed, there is good reason to suppose that different kinds of subject will require different norms; it may well not be possible to compare performance in narrative writing with that in discussion (*vide* Schonell p. 370). It would be interesting to devise a marking scheme whereby a portion of the marks was allotted to an estimate of the writer's skill in using basic composition skills, particularly if the method was made clear to candidates.

So far this material has been represented as being of use to an examiner. Such an approach is almost inevitable in view of the importance attached to examinations by our educational system. But in conclusion I would like to suggest two uses of these composition norms (and, of course, of composition scales themselves) which are,

in my opinion, far more productive. At the diagnostic level, information of this kind can show generally whether a writer's performance in composition work is lagging seriously behind what might reasonably be expected from his level of general intellectual ability. More specifically, these norms might be used to show where specific weaknesses lie, so that remedial work may be applied. It is here being argued that it is not the primary business of instruction in composition skills to produce essayists in the style of Lamb or Hazlitt (the unfortunate aim of many English specialists), but competent writers of continuous prose, a skill essential in a technological age such as is ours. This leads naturally to the second use—the teaching of composition work, a task so difficult that it is sometimes barely attempted. A study of the basic skills (and consequent weaknesses) of English composition might lead to a rethinking about methods of instruction more efficient than many now in use. This might produce a breakthrough in the international problem of illiteracy.

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THE USE OF SELF-EVALUATION PROCEDURES BY LECTURERS IN EDUCATIONAL PSYCHOLOGY

by RAY H. SIMPSON

Professor of Educational Psychology, University of Illinois

I. INTRODUCTION

THE current expansion of higher education has led to a pre-occupation with methods of teaching and learning at the university and college level. This article is written in the belief that, since many of the problems which arise are comparable in the two countries, research into methods of teaching in colleges in the United States will be of interest to colleagues in Britain.

It is quite likely that most lecturers in education believe that improvements in their methods of teaching would be desirable. Some, as indicated by their out-of-class behaviour, do not feel strongly enough about the need for improvements to take systematic steps to produce changes. However, there are significant numbers of lecturers in the U.S. who do take definite steps in this direction. Sometimes changes represent rather cursory stabs based on random stimuli which have been received. Other lecturers systematically try to diagnose their strengths and weaknesses to form a sound basis for a pattern of change.

The article describes some aspects of the use of self-evaluation procedures by lecturers in psychology, but the findings may obviously be generalised to a degree to other subjects. More specifically, the objects are as follows:

- (i) To indicate procedures which might prove helpful to the lecturer in psychology in making continuous and systematic self-evaluation of his teaching.
- (ii) To suggest procedures which heads of psychology departments may wish to encourage their staffs to use.
- (iii) To show which self-evaluation procedures have been used most frequently by a sample of lecturers in psychology.
- (iv) To describe which procedures have demonstrated the highest ratio when used by a sample of psychology teachers.

- (v) To suggest the procedures which lecturers in psychology are probably most interested in trying for the first time.
- (vi) To indicate how psychology teachers compare with college and university teachers in other fields in (a) actual use of self-evaluation procedures, (b) successful use of such procedures, and (c) interest in trying new self-evaluation procedures.

2. PLAN OF INVESTIGATION

The writer, together with other members of the Subcommittee on the Improvement of Instruction of The American Association of Colleges of Teacher Education,* prepared a list of 17 "Teacher Self-Evaluation Procedures". This list is shown in Table I. The following paragraphs quoted from a letter sent by the Subcommittee to AACTE Institutional Representatives give a picture of how the primary information here reported was gathered.

How do your faculty members evaluate their effectiveness as teachers? The AACTE has requests from member institutions asking for suggestions on kinds of teacher self-evaluation approaches which might be used. Your Subcommittee on Improvement of Instruction believes the accompanying questionnaire will provide data which will be of help in answering these requests.

In an attempt to emphasise and facilitate instructor self-evaluation of teaching, your Subcommittee on Improvement of Instruction has developed the attached diagnostic tool. It is designed with two purposes in mind: (a) to suggest self-evaluation approaches to staff members, and (b) to help your Subcommittee on Improvement of Instruction to describe current practices.

If you are interested in using this tool with members of your teaching staff, we will supply two copies for each of your staff members to complete. We ask that one completed copy from each staff member be returned to us. We suggest that the other copy be retained by the staff member as a reminder of some of the possible approaches he might want to try in self-evaluation of his teaching.

A total of 251 psychology teachers from 84 colleges and universities returned completed questionnaires to the AACTE office in Washington, D.C.

3. STATEMENT OF RESULTS

A summary of some of the key responses of 251 teachers is given in Table I, where the procedures are ranked in order of the number of successful users.

* Members of the committee included Harold Hyde, *Chairman*; Paul M. Allen, William E. Engbretson, Carl Gross, Truman M. Pierce, Herbert Schuler and Ray H. Simpson.

TABLE I

SELF-EVALUATION PROCEDURES LISTED IN ORDER OF NUMBER 251 PSYCHOLOGY LECTURERS WHO HAVE USED THEM AND FOUND THEM VALUABLE

Item No.	Procedure	Used and Found Valuable	Used and Found of Doubtful or No Value	Success Ratio*	Might be interested in Trying
1	Open-ended, relatively unstructured, evaluation by students.	126	31	4.1	45(18%)
2	Self-constructed evaluative questionnaires or checklists to be filled out by your students.	111	32	3.5	41(16%)
3	Comparative check on your efficiency using one teaching approach vs. your efficiency in using another approach.	102	8	12.8	54(22%)
4	Voluntary and continuing colleague discussions or seminars by teachers of a particular course.	100	3	33.3	66(26%)
5	Visiting in a colleague's class for the purpose of evaluating and improving your own classes.	81	11	7.4	55(22%)
6	Published teacher evaluative instruments.	71	26	2.7	71(28%)
7	Yearly written recap. of own activities and an assessment of the strong and weak aspects of such activities.	70	4	17.5	64(25%)
8	Systematic search in printed sources for diagnostic tools and procedures for self-evaluation.	56	7	8.0	46(18%)
9	Planned meetings with colleagues for the purpose of evaluation of your own and others' teaching.	51	3	17.0	84(33%)
10	Comparative ratings by your students on specified dimensions of your instruction vs. that of other instructors.	39	18	2.2	52(21%)
11	Soliciting the help of administrators or supervisors in evaluating one's own teaching.	37	6	6.2	45(18%)
12	Tape recording or TV recording of regular class sessions and then feedback analysis on your part.	33	6	5.5	96(38%)
13	Student evaluation committee to provide feedback to the teacher.	25	8	3.1	12(5%)
14	Regular luncheons to discuss evaluations of own and others' teaching.	23	4	5.8	79(31%)
15	Other action research, in addition to that in No. 3 above, to test teaching efficiency.	17	1	17.0	28(11%)
16	Tape recording of an evaluative class session in which strengths and limitations of classes are analysed. (This discussion to be led by the instructor, by a student, by a panel of students, or by a colleague.)	13	2	6.5	71(28%)
17	Co-operating colleague who near the end of a semester or quarter leads a discussion in your class of strong points and weak points of the class with you absent.	3	3	1.0	73(29%)

* Success ratio is determined by dividing the number of successful users by the number who found the procedure to be of "doubtful or no value".

It should be made clear that the criterion of success was subjective: each lecturer made his own judgment as to the success or failure of any procedure he had used, and this is the operational definition of the term "successful user" throughout the article. However, it seems reasonable to assume that those procedures with relatively large numbers of successful users merit special consideration, both by lecturers wishing to improve their teaching and also by department heads who desire to promote self-improvement in members of their staffs. It is interesting to note that the least "Used and Found Valuable" procedure, "Co-operating colleague who near the end of the semester or quarter leads a discussion in your class of strong points and weak points of the class with you (the lecturer) absent", has only 3 successful users. On the other hand "Open-ended, relatively unstructured, written evaluation by students", had 126 successful users, or about half of the total number sampled.

Although the gross number of successful users is one indicator of the potential value of a particular procedure, another and possibly more significant measure can be obtained from a comparison of the number of lecturers who have used a procedure and found it valuable with the number who have tried the same procedure and have found it of doubtful or no value. For example, it can be seen in Table I that item No. 6 and item No. 7 had approximately the same number of successful users, 71 for No. 6 and 70 for No. 7. However, item No. 6 had 26 dissatisfied users while No. 7 had only 4. Hence, item No. 6 gets a success ratio of 2.7 (71:26) as compared with the extremely high success ratio of 17.5 (70:4) for item No. 7. It would appear, therefore, that item No. 7 might be a significantly "better bet" for tryout than item No. 6.

The numbers in the last column of Table I indicate the number of lecturers who "might be interested in trying" each procedure. These figures and the comments volunteered by lecturers clearly indicate an urge to try out many of the procedures. From comments it also appears that a major barrier to tryouts is uncertainty as to just how to go about trying particular procedures. This information should prove helpful to department heads and teaching improvement committees who wish to aid colleagues in improving their systematic self-evaluation.

Table II compares the responses of the sample of 251 psychology lecturers with 5,052 lecturers in 16 other fields in the use of and in the desire to use self-evaluation procedures. Apparently psychology lecturers have a higher average tryout rate than lecturers in other fields.

TABLE II

COMPARISON OF 251 PSYCHOLOGY LECTURERS WITH 5,052 LECTURERS IN OTHER FIELDS IN THE USE OF AND IN THE DESIRE TO USE SELF-EVALUATION PROCEDURES

<i>Subject Field</i>	<i>Average Number of Procedures Tried</i>	<i>Success Ratio</i>	<i>Procedures Average Instructor Might be Interested in Trying</i>
Psychology	6.61	8.1	4.1
Pre-professional*	5.2	8.1	4.1
Industrial Arts	5.0	4.6	3.93
Art	4.79	3.9	3.50
Physical Education	4.77	7.7	4.5
Domestic Science	4.75	10.0	4.0
Education	4.7	7.0	4.2
Speech	4.5	4.94	3.51
Biological Sciences	4.40	5.1	3.3
Music	4.39	7.2	3.86
Social Science	4.0	4.2	3.6
Agriculture	3.95	5.4	3.7
Commerce	3.93	5.46	3.8
English**	3.8	3.7	2.8
Physical Sciences	3.6	4.8	3.0
Foreign Languages	3.3	5.55	3.2
Mathematics	3.1	5.03	3.55
Miscellaneous	5.55	5.54	4.7

*Pre-professional = pre-nursing, pre-dental courses, etc.

**Includes courses on the mechanics of expression.

In success ratio in the use of procedures, and in the wish to try out more procedures, psychology lecturers are sixth from the top out of 17 fields.

This table possibly raises more questions than it answers. Some of the questions it suggests are these: Are subject fields which are well established from a status standpoint less interested in using critical self-evaluation than those in status-seeking fields? Are lecturers in fields where there is great use of self-evaluation procedures more experimentally minded than those in fields with low ratings? Or are they those with least confidence in the efficiency of their teaching? Are lecturers in fields with low ratings and individual lecturers with little use of self-evaluation tools too complacent for their own good? Do high-rated subject matter areas (column 2) indicate lecturer's dissatisfaction with their own teaching in these areas? Do low ratings indicate low regard for or a negative reaction toward the whole concept of teacher self-evaluation?

Moreover, do some fields such as psychology lend themselves better to the use of self-evaluation procedures than other fields such as English? Or is it the case that English teachers put more faith in their *intuitive* judgments than lecturers in areas, such as physical education, which have a relatively high successful use of tools to supplement their subjective judgments. It would seem from an examination of Table II that lecturers in certain fields with high ratings, such as psychology, are probably more interested in current human behaviour and interpersonal relations than are lecturers in some areas, such as mathematics, with low ratings.

Another possible reason for the differing concerns in various areas for systematic self-evaluation may lie in differences in the motivational structures in different fields. Assuming this may be the case, perhaps the value structure in fields with low ratings is such that improvement in teaching is perceived as of relatively low importance by lecturers. This may be largely due to what each individual lecturer perceives his colleagues to be thinking. Possibly composing, writing, or research are given greater priority in the value structure common to teachers in a particular field.

There appears to be little doubt that there are significant differences between psychology and some other fields insofar as attitudes toward and use of teacher self-evaluation procedures are concerned. The causes of these differences and the validity of prevailing attitudes in psychology and in other fields would seem to merit further study.

4. ADDITIONAL SELF-EVALUATION PROCEDURES VOLUNTEERED BY LECTURERS

In addition to the 17 procedures whose current and potential values were partially evaluated in this study, 5,303 lecturers in psychology and other fields suggested a total of 27 additional approaches or procedures which they had found useful. These additional approaches are indicated below under five categories:

1. Lecturer's written assessment of own teaching:
 - (1) Teacher-constructed self-evaluation check list
 - (2) Written teacher evaluation after each class
2. Student achievement in school and out of school:
 - (3) Follow-up of former students in graduate work
 - (4) Structured test to check achievement against objectives

- (5) Comparison and analysis of student achievement with norms on standardised or teacher-made tests
 - (6) Departmental oral, written, or performance examination of students
3. Work with colleagues:
- (7) Workshop to construct teacher evaluation instrument
 - (8) Observation and evaluation of classes by invited colleague
 - (9) Questionnaire constructed by faculty committee
 - (10) Interaction through team or panel teaching
 - (11) Use of guidance specialist to help analyse teacher-student social-emotional climate
 - (12) Exchange of material with colleagues or lecturers in other teacher-training institutions
4. Adapting from other occupations:
- (13) Adaptation of evaluative processes from industry or non-educational occupations
5. Use of students:
- (14) Have nonclass member who is an advanced student observe and evaluate all class sessions
 - (15) Informal discussions with small groups and individual students
 - (16) Reaction sheets given to students after each class during selected parts of the term
 - (17) Class-constructed evaluation instrument
 - (18) Use of student self-evaluation as one check on teacher efficiency
 - (19) Class evaluation of its own progress
 - (20) Eliciting judgments of bright or "reliable" students
 - (21) Faculty observations of student reactions
 - (22) "Keeping ear to the ground" for evidences of student reaction
 - (23) Have one class session devoted to planning for the following year, thereby bringing out student-perceived strengths and weaknesses of current class
 - (24) Role playing with student assuming role of lecturer to help the latter assess student perception of him
 - (25) A different student each day assumes role of class evaluator
 - (26) Evaluation instrument prepared by student council or university student committee

- (27) Individual conference with poor students to determine causes of weaknesses.

It may be noted that the original items on the questionnaire could have been categorised under similar main headings to the five used above.

5. CONCLUSIONS

This study of the self-evaluation approaches used by 251 psychology teachers leads the writer to conclude that the use of teacher self-evaluation tools among psychology lecturers in colleges and schools of education is widespread. Further, all of the 17 tools investigated seem to have at least as many successful as unsuccessful users. However, a pronounced difference exists in the degree of successful use among the various procedures. (A high success ratio of 33.3 as against a low of 1.0), with the most used procedures being frequently not the ones with the highest success ratios.

There is a very widespread desire among psychology lecturers to try out some procedures with which they are currently unfamiliar. Lack of knowledge of how to go about self-evaluation is a restraining factor, and this implies the need for professional study and possible guidance from more experienced colleagues or others.

The use of self-evaluation procedures, their successful use, and the urge to try out new tools varies widely depending on the subject field involved. Although the significance of high ratings in the use of self-evaluation tools is debatable, psychology rates highest in use, and above average in successful use and urge to try new procedures when compared with ratings from other subject fields.

The number of self-evaluation approaches is very large. Seventeen were studied intensively here, and an additional 27 were suggested by the co-operating lecturers. That 44 procedures for self-evaluation are available would certainly come as a surprise to many college teachers. Most college lecturers are unfamiliar with many of the available self-evaluation procedures.

In effect, systematic self-evaluation has excellent potential as a major approach for the improvement of college teaching. More knowledge and study are needed in the area, particularly in view of the increasing demand for competent college and university teachers.

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GROUP METHODS OF TEACHING IN HIGHER EDUCATION: THE BACK- GROUND OF SOME NEW APPROACHES

by E. A. ALLEN

Department of Education, University of Nottingham

I. WHY GROUP METHODS ARE NEEDED

IF students learn in ways that are predominantly passive their higher education will not affect them much, and in this case resources are being wasted, even at present. We need to have more "active methods", more group work. The teaching, as well as the campus life, should be aimed at facilitating the whole personal development of students.

Different teaching methods will foster different emotional as well as intellectual characteristics in students. Group methods of teaching seem likely to help in both directions. Intellectual and vocational training are surely only a part of the personal development that higher education can promote. In fact if education did promote whole personal development, people's appetite for it might not become so blunted.

In lecturing, and other methods where the teacher is much in evidence, there is little interaction between students. It is important therefore that this should not be the predominant learning situation. If it is, then wrong attitudes of dependence and irresponsibility may persist, and individual difficulties are less likely to be resolved. In intellectual terms alone, if the teacher's role of "liquidator of ignorance" is overplayed, he will liquidate other things instead. Motivation and learning are not entirely rational processes. There is a necessary penumbra of irrationality which group discussion, but not lectures, can take account of. For students to learn, it is not always enough for the teacher to explain lucidly; it is not enough for *him* to have covered the ground; there must be interaction, especially between students; *they* must cover the ground. The more "withdrawn" students, too, need to be drawn out. One has only to consider what is meant by "a good student" to be reminded that higher education is not solely concerned

with increasing students' knowledge, but with attitudes, habits, beliefs, professional skills, confidence, ability to communicate, and many other aspects of behaviour.

Strong support for using more group-centred methods to embrace all these aspects of behaviour is to be found in work in social psychology which demonstrates the effectiveness of group decision and the power of the group to influence individual behaviour, and in the traditional university tutorial system, in Rogers' client-centred counselling, and finally in the activity methods of lower levels of the educational system.

The Power of the Group

Lewin showed the superiority of discussion methods in attempts to change the food habits of housewives in wartime. Discussion led to the elaboration of difficulties by the housewives themselves, and recipes were offered only after the ladies had become sufficiently involved in the matter to want to know what could be done, and the group had committed itself to give unfamiliar foods a try. Similarly in attempts to change mothers' ideas and practices of infant-feeding, changes were more often effected with the mothers in groups than singly.

Levine and Butler showed that in training factory supervisors to rate the performance of workers more validly, only those supervisors who discussed the problem and decided what to do about it improved their rating procedure. Neither increased experience in rating nor information given in lectures about previous errors in rating had any effect.

The significance of group decision was brought still more into focus by E. B. Bennett, who tested various ways of getting psychology students to come forward as subjects for psychological experiments. She showed that for discussion to be effective in producing the required action, a decision must be specifically called for, and a high degree of consensus in the group felt in regard to it.

There are reservations, of course, that one would have about these experiments. The centrality of the issue, the quality of both the "lectures" and "discussions", and whether the group has some life of its own apart from the experiment, are questions that need attention. One might also say that students generally in higher education are more receptive to lectures and less resistant to required changes. However, this remains to be verified empirically. The relevance of all this to higher education can nonetheless be made clear. Even if

people know what they should do, they may yet not do it. A degree of involvement is required if students are to change their attitudes, beliefs, and habits as well as their knowledge in directions desired by their teachers and demanded by their disciplines. This involvement implies a degree of participation which lecturing by its very nature precludes. In discussion the teacher is more aware of the feeling of the meeting and of what obstacles have to be overcome; and the group's deliberate commitment can be built in to the proceedings.

Lewin argued that it is easier to change the ideas and practices of a small group than of single individuals because the individual is more resistant to change on his own, and is more likely to change if the group does so, and in discussions more evidence is available to him than it is changing than in lectures. It seems likely that in a congenial group not only will the individual tend to be less resistant because he is not on his own, needing in a sense to defend himself, but also he is able to be constructive and to volunteer helpful leads.

That to achieve their best, discussions need leaders with creative ideas relative to the matter in hand, and with certain conference skills, is underlined by experiments in management training by N. R. F. Maier (1950). By asking questions that both stimulated thinking and influenced its direction, "expert" leaders had their ideas *rediscovered and accepted* by the group members.

Experimental findings such as those of Sherif on the formation of norms in a group, and of Asch on the conditions of independence or submission to group pressure have established that the group has power to convince many of its members. It is clear that under certain conditions unreason supported by a majority can command assent from the individual. In academic discussion however, although matters to be judged are even less clearly structured than in those experiments, where e.g. lengths of lines had to be compared, there is, specifically, exchange of argument, and there is no rigging of the majority's judgment. All the same, where there is an erring majority, it behoves the tutor to keep the discussion open, or he may simply give more power to the blind leading the weak. He can usually expect someone in the group to detect unreason and to interpret it. He can step in and do so himself if no one else does. Indeed on occasion by his intervention he can communicate a feeling for more precision.

Both M. L. Johnson and S. A. Barnett, reporting experiences in teaching biological science undergraduates, describe how discussions *bring out* the way in which each student looks at a topic on the basis of his own experience and bias. These biases can sooner or later be

corrected by other students, as they *gradually formulate their thoughts in free discussion*. Some teachers might see this as merely floundering; but it is a necessary stage in learning to swim. Experimental evidence on this point comes from Maier and Solem who, using a large number of groups of students, demonstrated that free discussions tended to increase the number of correct answers to a problem for which a variety of incorrect answers seemed plausible. This showed that opinions which corresponded with reality had more influence than those which did not. It showed, too, that discussions with a definite leader are more effective than those without because the leader can permit minority opinions to exert a constructive influence. A minority, it appeared, could effectively compete with the pressure of the majority only when the minority had reality on its side.

The group has therapeutic power as well. It is known to be easier to rehabilitate people—alcoholics, mental patients, and to some extent law-breakers—in groups than singly. Rehabilitation seems often to involve healing psychological injuries sustained in early family experiences. W. R. Bion's articles showed how emotions are worked off in a permissive group of fellow-sufferers. A group provides a person with opportunities for relating himself to people—learning how to express himself, how to behave—and also for experiencing reassurance of his own worth.

It is recognised that attitudes, enthusiasms, opinions, ideas, experiences, and information are communicated between students outside the classroom. In group methods of teaching this process can be facilitated. Since groups exist anyway among students, the power of the group should be harnessed for the teacher's purposes.

The Tutorial System

The traditional tutorial seems to guarantee maximum "contact of minds", in that communication is free and immediate. It implies regular and frequent papers by the student, immediate "knowledge of results", and personal teaching based on efforts the student has already himself made. Disadvantages are that even at their best, tutorials are expensive in tutors, students do not have them often enough, and in any case more than one or two students are needed to produce sufficient interaction. Seminars, lecture-discussions, and "classes" are evidence of modern universities' attempts to gain some of the advantages of the tutorial system. Useful discussion is given by H. S. N. McFarland (1962) of psychological and academic functions of tutorials, and D. G. Macrae has commented on under-graduate

seminars and classes. This is where the *group* can be used in teaching, if the teacher is willing to take a less dominant part.

Counselling

Further arguments for using the group are suggested by the client-centred counselling techniques of Carl Rogers, the purpose of which is to help people to talk themselves into solutions of their problems. A person only acts effectively to solve his problems when he has accepted that they are problems and are worth solving. Solutions offered by someone else, especially someone in authority, may generate resistance or dependence and certainly will short-circuit the prior thinking and insights necessary for complete working-out of the problem. Hence every man is his own best problem-solver: all he needs is help to talk himself through all the steps. For students on any given course in higher education many problems are common to the group. So the recurring responsibility for seeing that there is a problem, and defining what precisely it is, could be passed to the group, in more interactive discussion methods, thus creating the problem-solving mood, in which students are most minded to try something new or to acquire the knowledge they lack.

Activity Methods

More deliberately active ways of learning, having revolutionised the teaching of infants and then juniors, have to some extent spread upwards. Students, too, should do as much for themselves as possible rather than be passive and dependent. They need the free range rather than the battery system. This is important because they ought to go on after their teachers have finished with them. The teaching should fulfil two criteria: to be efficient in the short-term, and to enhance capacity for self-development afterwards. We should therefore expect activity methods just as much in higher education. The question should be: what are the most active non-dependent ways possible for given students to learn in a given area of subject matter?

2. USING THE GROUP IN TEACHING

The Fundamentals of Group Methods

Hardly any details can be quite common to all teachers and subjects; it is more a matter of emphasis. The first emphasis is on the value of establishing a good group feeling. People who work together tend to come to like, or at least accept, each other. This process can be accelerated so that a congenial group with a life and a compelling

force of its own develops as soon as possible. Then students are working as much for the group as for the teacher.

The second emphasis is that basically the group discusses what it wants to discuss. They know what they are there for, and will in general want to maximise the achievement of this aim. They can, if the teacher wishes, have whatever freedom he himself has in deciding what the group is going to do. Naturally his expertise comes into this, but as supplementary rather than as the starting point. The emphasis is on letting students plan the course as much as they can. Once an outline has been drawn up with the group in open discussion, taking into account any lectures that are to be given, and other fixed arrangements, more detailed planning for specific discussions can be undertaken by the tutor and the small groups of students who will introduce them. Plans need not be made for too many discussions ahead. Participation and intensive preparation can be spread in these ways throughout the group; and since discussion material can be announced or distributed beforehand, it can be made as sure as possible that all students come to the meetings prepared and having something to say.

The third emphasis is on the emotional aspects of learning. Prejudices, preconceptions, biases, worries, and irrelevancies, are "brought out" to be dealt with. Correspondingly, good-nature, enthusiasm, humour, and the feeling for argument are brought out. In group methods students are encouraged to say what they feel. The tutor does not sit in judgment. If a contribution is significantly out of line, he allows this to become apparent in discussion, keeping the discussion open on the point if necessary for the group to deal with it.

A further emphasis is on activity rather than passivity of students. Getting them all to participate in the talk, and seeing all have things to do on behalf of the group, are aspects of this. So is the demand for frequent short pieces of written work, in which there is a large element of choice, and the expectation that the work shall be distinctively personal in some way, and not simply a regurgitation. Similarly when the group is ignorant on some point in discussion, even though the tutor knows the answer, it is sometimes useful to get someone to read it up, or work it out and report next time. In any case, since small groups tend to develop a "life" of their own, activity is likely to extend into spare time.

In the tutor's role the emphasis is on creating the conditions of free discussion by *joining* the students. So he sits with them rather than behind his desk, for example. Then remarks soon stop being

addressed primarily to him and become directed to the group. Then a group is formed in place of an audience, and more reticent or apathetic or hostile students become less so, and participate more. He maintains free discussion by helping some members not to "hog the discussion" and others to join it, and by protecting minorities but not taking sides. Often, unless asked for his opinion or facts, or until his intervention is needed, unlike student members of the group, he might just as well keep quiet. If he has to intervene, he does so, as any other member would, by raising a question. If there are topics he feels bound to take to himself, this will be made clear beforehand; but it should not be too often that this happens, otherwise the students are again made, in a sense, irresponsible. Leading the discussion—introducing the subject, breaking it down, raising questions about it—can be done by two or three students, and they can depute one of their number to take overall charge at the meeting. On tutor's interventions Barnett puts well an experience that many who successfully use group methods must have: "Sometimes the tutor interjected questions, but these were commonly ignored, and the students persisted (quite rightly) with their own trains of thought. Towards the end, however, there appeared a tendency to pay some attention to the tutor's questions!"

Finally he has to "call time" and possibly summarise the discussion. Often this had better be a very brief matter indeed, since the more he says in some cases the more he will tend to re-open some of the issues and start a new discussion, which according to the rules of the game he will be bound to permit. The chief need is to underline progress made and to leave openings for subsequent occasions, something to take away. A good laugh is a good note to end on.

Some Difficulties

There are always limitations to what the teacher is free to do with his courses. The syllabus and some of the teaching arrangements are laid down. He cannot step far out of line from his colleagues. So he must size up the extent of his own freedom and only put so much, or as much of it as he will, at the disposal of his students. This freedom must then be given unequivocally. Much of the point is lost if authority pops in again through the back door. The students do not know where they stand.

Discussion with a large group is difficult, especially in a room which is unalterably a lecture room. But for many of the advantages to be obtained the size and shape of the group are only limited by the

need for all to hear what is being said by anyone talking naturally, for members to be face to face, and for the teacher to take a place no different from that of other members.

Discussion skills might not develop sufficiently in a group by the time the initial phase of novelty and enthusiasm wears off. H. J. Hallworth suggests the teacher prepares the group for this and exhorts them to see the thing through. However, it seems just as good to encourage the habit of discussion before exposing the group to full responsibility for its own progress. Again, since certain skills and attitudes and information are demanded, the quality of discussion at first depends partly on the earlier educational experience of students. Those from an authoritarian régime could be at a disadvantage. But if, as the Hale Committee point out, the most important purpose of a university education is to teach students to think for themselves, teachers have an obligation to wean them from dependence as soon as possible. To postpone discussions until a stage in the course when students have been given enough to discuss is to prolong their dependence, and inhibit their self-activity.

Individual students might be over-critical or hostile or otherwise ungroupable, though the present writer has not found this to be a particular difficulty in his own setting. Suggestions have been made that awkward students can be put to good use. They can be critical in the service of the group, even being asked to analyse and appraise a given discussion, for example. M. Swainson, reporting successful and unsuccessful group work, mentions a class with so many problem students in it that it never functioned as a group at all. However, teacher-centred methods could hardly be any more helpful than group methods in such a case. Clearly therapeutic requirements make group work all the more appropriate. The case is interesting for a number of other things that had gone wrong.

The reticent student is another problem, though not so much as one might think. If some students remain silent in discussion it often means simply that the group is too large and should be split up some of the time. Individuals should not be forced to say something: they have as much right to keep quiet as to speak. In general, the participation of the group is structured into its programme, all taking turns. Besides this, the ordinary good-nature of the group's proceedings encourages people out of their shells where necessary, and this can be further helped by the tutor, who affirms the acceptability, for the purposes of discussion, of whatever contribution anyone might make, so that the student's fear of putting his foot in it is minimised.

Finally, the tutor himself might not be personally suited to taking a back seat a good deal of the time. In this sense he himself might be ungroupable. It is a question of wearing authority lightly, or putting it aside, of not too evidently knowing it all, or else students will continually look to him for corroboration or approval.

It is suggested that methods along the lines described have a much needed contribution to make, along with lectures, especially in an expanded higher education system, in which requisite motivation and attitudes of students seem likely to be even more important to foster. One would think that the unique advantages of lectures are more likely to be obtained if they do not take up too large a part of the time. On the other hand tutorials are too extravagant in resources to play a major part, and they also lack the advantages of interaction between students. Between lecturing and tutorials there is a wide area of teaching left in which the teacher can find the degree of student-participation he feels is right.

Some more Directed Methods

Small group work can be done in larger classes, even if need be in the middle of a lecture. Where a problem has to be solved or opinions arrived at, the large class can be split into groups *in situ* and given a stated time to discuss and have someone prepared to report back. This is an excellent way of getting problem material discussed on the spot, and the groups produce remarkably diverse and useful contributions. Let the lecturer who is loath to let go of his audience consider how he might relish conducting half a dozen discussions at once!

Co-operative study is not, in any case, confined to class periods and the behest of the teacher. Even if tutors have not often observed their students outside lectures occupied co-operatively in routine work of the course, they will at least have noted that students often revise together for exams. J. T. Blue produced evidence to suggest that students improved their results by studying in organised groups rather than individually. J. P. Powell mentions having recorded a series of leaderless student discussions in which, due preparation having been made, there was vigorous interaction and remarkably few cases of factual mistakes passing uncorrected.

A group develops a life of its own, which persists from one meeting to another; and its activities extend into the intervening periods. Advance notice of discussions, preparation of paper, and prior distribution of discussion material, and the group's decision that certain reading will be done by a certain time, all contribute to this. Also

students can be provided with work sheets of questions to aid them in prescribed reading. Questions create gaps needing to be filled, which the learner, by way of reflex, does something about filling. These strengthen the urge to undertake necessary reading, and also act as a framework around which reading can be discussed, in or out of class. McKeachie and Hiler's study suggests that such work sheets are effective in terms of retention and comprehension of the material if students are *required* to work them out; and increased learning is not confined to text material covered by the questions.

All the approaches mentioned in this article revolve around *problems* and *activity*. Democratic leadership and effective teaching are only different aspects of the same principle—of handing people problems rather than solutions. Group problem-solving, or the workshop approach, which has so radically changed the education of young children—where different things might be going on at the same time, and where the teacher is much of the time ostensibly no more than 'on hand'—is a principle equally applicable to ideas and information as to more manual and menial things. There are indications, too, that in being offered more active democratic methods, students appreciate being treated more as adults.

Since school teaching requires people who are adjusted and independent of mind as well as knowledgeable, it is not surprising that group methods have made headway in teacher training. Should not the adjustment and the independence of mind of other students be considered important as well?

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THE PLACE OF CONTEMPORARY HISTORY IN THE SCHOOL CURRICULUM

by D. B. HEATER

Senior Lecturer in History, Brighton College of Education

I. THE PROBLEM OF THE HISTORY SYLLABUS

IT is not pedantic to suggest that the economic pressure towards journalistic book-making . . . has, in its demand for 'being with it', brought 'history' up to a point where the word makes nonsense. What documents, indeed what possible standpoint of objectivity, can Mr Hopkins contribute to the events of 1959 which can be more than the random impressionism of a steam radio (let us be with it) scrap-book?" (1) Thus wrote Angus Wilson in a review article in *The Observer* two years ago. Clearly the lay mind is becoming aware of an issue which is exercising the minds of teachers of history: namely, how far recent events should be included in the study and writing of history. Mr Wilson's comments are a challenge to us to know our own minds on the subject.

The discussions that have taken place recently in professional circles have been provoked largely by the need to rethink curricula in the light of the Beloe, Newsom and Robbins Reports. The whole range of education from junior school to university is affected by the discussion. For if the academic teaching of history at the secondary level and above is to have any sense of purpose, the history taught in the junior school must be in sympathy with that purpose, must, in Dr J. L. Henderson's phrase, provide an "underpinning" for the more advanced work (2).

Yet the impetus given to educational thinking by recent government reports is no more than a necessary reaction to the contemporary "education explosion", a process almost as revolutionary in its implications as the more publicised "population explosion". For it is quite evident that the history suitable for mass education in the second half of the twentieth century is very different from that suited to an educated élite living in Victorian Britain. The traditional history of England "from Julius Caesar to the First World War", still remarkably common in our schools, is a reflection of the insular attitude to world

affairs and a self-contained attitude towards "subjects" which characterised political and educational thinking respectively a generation or so ago. Most thoughtful teachers to-day are well aware that the criteria of the 1930s are ill-suited to the construction of a history syllabus in the 1960s. Unfortunately, however, in the constructive work of building new syllabuses there has been much fumbling and uncertainty. A useful rule-of-thumb might be provided if history syllabuses could be submitted to a threefold process of integration, internationalisation and modernisation. Subject barriers must be broken down in order that the natural links with such neighbouring studies as geography and literature may be laid bare. Secondly, although children must be aware of the traditions of their own country, a consciousness of Britain's place in the wider, global community and of other people's traditions is essential in our present interdependent world. Finally, the study of history should be carried chronologically to the present day to "enable children to use it as a springboard for the future" (3). The most contentious of this triad is the proposal for the chronological extension of the history syllabus until it becomes virtually fused with current affairs.

2. THE DEBATE ON CONTEMPORARY HISTORY

Broadly speaking the strongest arguments for the teaching of contemporary history derive from educational considerations; the opposition derives its greatest force from the philosophy of history.

It is the experience of many teachers of history that there is considerable latent interest, especially among "teen-agers", in the history of the past half century. This interest is very natural, as Miss E. M. Lewis has pointed out: "It is trite to insist that what the adolescent desires and needs is to feel at ease in the adult world. But it is true. A course about current affairs helps him to feel at home in the environment of his seniors; it minimises the sense of inferiority in general knowledge of the world, which he finds so galling" (4). It is a point of view loudly echoed in the Newsom Report (5). However, the mature nature of this kind of study is not the only attraction. The clear relevance of the recent past for an understanding of the present, the living evidence of historical causation, give a reality to contemporary history which is lacking for many pupils in more remote periods. This sense of reality is strengthened by the reminiscences of parents and older relatives, and the constant flow of factual and fictionalised accounts of recent history in popular film and paperback forms. Film-producers and book-publishers are fully aware

that the drama which has unfortunately characterised the history of our own century will ensure a large market for their productions. These sources provide the teacher with both an opportunity and a challenge. The opportunity lies in the wealth of material that can be selected as teaching aids (especially valuable as the more conventional aids are at the moment in poor supply); the challenge lies in the teacher's duty to provide an academic corrective to the distortions that will sometimes inevitably result from the adolescent's uncritical reading and viewing. The duty of the teacher to provide some form of political or civic education is, to some minds, an overriding consideration. Even the Newsom Report becomes passionately dogmatic on this question: "A man who is ignorant of the society in which he lives, who knows nothing of its place in the world and who has not thought about his place in it, is not a free man even though he has a vote" (6).

Yet, in England especially, this civic education receives but grudging attention in many time-tables and syllabuses, and faces even positive resistance in some quarters. Many teachers will declare, contrary to the view put forward above, that the subject is not a popular one: that school children, however sophisticated they wish to appear, are not ready for the study of political subjects which are essentially adult in appeal; that world-wide political issues are outside the child's environment and therefore his comprehension, and consequently any political studies beyond the Town Hall are to be avoided; and that children feel that there must be some kind of propaganda content in the lessons, however impartial the teacher strives to be, and are therefore suspicious and resentful. Much of the force of these arguments is, in fact, lost when one asks whether the fault is not rather in the teacher's handling of the subject than in the subject itself. The Newsom committee discovered plenty of resistance in schools to lessons on civics or current affairs, yet is convinced of the possibility of the successful handling of such subjects: "If other schools can tell a different story, and they can, we are not confronted with a psychological barrier which prevents people of below average intelligence, that is to say about half the nation, forming a responsible and reasoned opinion about public affairs. Optimism is possible. The important thing is to discover and apply the means by which it can be justified" (7). The possibility of comprehending public affairs certainly need not be confined to parish pump issues; indeed, through television and the popular press, the wider world is probably more real to the average child than his own immediate environment, which

he takes for granted and therefore ignores as uninteresting. In the words of Dr King: "The world is at last our neighbour; and our father and mother may be strangers" (8). One suspects therefore that the key to the question lies in the ability of the teacher in handling the subject in the classroom.

We are left, in our list of practical arguments against the teaching of contemporary history, with the issue of propaganda, which, as one aspect of the problem of bias in history is, of course, beyond the scope of the present article (9). Starting at the classroom level, we can distinguish a number of obvious lines of hostile argument: the teacher cannot be trusted not to use the lessons for propaganda purposes for a party or sectional cause; even the most honest teacher cannot possibly be completely unbiased, especially if he has a lively interest in the subject; parents might easily object to what they might believe (even unjustly) to be the indoctrination of their children. Yet the validity of any attempt to postulate a real distinction between "scientific" history and "prejudiced" current affairs can be challenged. All history worthy of the name must be written from a point of view. The difference between bias in history and bias in current affairs lies rather in the emotional intensity with which a particular view is held. But again, as with the stimulation of interest, the size of the problem will depend on the individual teacher. Even the most controversial topic in the hands of a skilled teacher can become, far from an explosive issue, a most useful exercise in judgment and the weighing of evidence. There are some teachers who might feel that they would not wish to accept this challenge; but then one does not wish to force teachers into this subject, but rather to encourage and trust those who feel that they could and ought to try.

We have still not, however, completely disposed of the problem of bias. For it may be argued that there is a qualitative difference between the kind of knowledge we can have of a truly historical period and that which is possible in the study of contemporary events; that a more objective truth can by definition be obtained by the historian than by the contemporary observer. Yet one may wonder whether the quality of historical hindsight cannot be over estimated. Professor Butterfield has reminded us that, "there is a profound sense in which all histories . . . are only interim reports" (10). And remarkably useful interim reports can be and have been written on the most recent past.

3. METHODS OF TEACHING CONTEMPORARY HISTORY

Throughout the discussion so far the terms "contemporary his-

tory" and "current affairs" have been used almost as if they were interchangeable. In many ways they are; but we have to face the practical question whether instruction should be given as separate current affairs lessons or as an integral part of the history syllabus.

It must be recognised, first of all, that not every history teacher has sufficient interest or knowledge to teach the subject effectively. It may therefore be administratively convenient to separate the teaching of history and current affairs on the time-table. Secondly, by divorcing history from current affairs on the school time-table history can be kept "pure", both in the sense outlined above and in another way too. For if we place too much emphasis on the importance of contemporary events we may find ourselves studying all periods of history not for their own sake but only in so far as they contribute to an understanding of the present. This, to many philosophers of history, is intolerable: a prostitution of Clio. Professor Oakeshott (11), for example, distinguishes between the historical past and the practical past: to the latter he denies the title of history.

The arguments in favour of isolating the current affairs lessons are, therefore, very powerful. Nevertheless, one may well consider that they are more than counterbalanced by the arguments that can be adduced on the other side. Michael Oakeshott's argument distinguishing between the two ways of viewing the past, although eminently useful for philosophical purposes, can be stood on its head when placed in a pedagogical context. The secondary-modern school pupil will view the school time-table with his usual utilitarian eye, note the distinction between current affairs and history and draw his own conclusion that if the former is practical the latter is useless! On the other hand, there is surely much to be gained in attempting to lead one's pupils into placing the present in an historical context, by presenting contemporary events as part of a natural historical sequence, not as something distinct. If one allows the history syllabus to flow on to the present day one avoids what must appear to the child as an artificial truncation of the course at an arbitrary date, whether it be 1914, 1939 or 1945; or "like reading the first three acts only of a Shakespearean tragedy" (12). Nor can the *dénouement* be adequately presented by the discussion of current topics in special lessons: there will always be an awkward hiatus between the date at which the history syllabus stops and that at which the story of any particular problem is started in the current affairs lesson. Furthermore, is there not a great educative opportunity to be grasped from contriving a constant comparison between past and present? But the process becomes

artificial if past and present are not viewed as being in the same dimension; if the present is lifted out of its context in time. Finally, this attitude of mind of viewing current events in as far as possible an historical perspective is perhaps the surest way of achieving a dispassionate and scholarly study of the contemporary world and escaping the traps of propaganda.

Much valuable thought and work along these lines is already being done despite the serious difficulties that face teachers at most levels through the paucity of good teaching aids (13). Publishers are becoming increasingly aware of the market for books on the subject, but there is a great leeway to be made good. In the meantime, a serious burden is placed upon the already overworked history teacher to prepare lessons and keep himself up-to-date with events.

The lack of books is perhaps most evident at the junior-school level, where admittedly the need is probably least pressing. Yet a Topic or Project study of a major country or area of the world would surely benefit from bringing its history up-to-date, particularly perhaps on a biographical level. A certain amount can be done also outside the structure of the ordinary lessons to make the junior-school child conscious that he is a member of a wider community than his school or town by publicising worthwhile charities such as Oxfam and observing special occasions such as United Nations Day and European Schools Day.

Much greater attention has been paid to the position of contemporary history in the secondary modern school, the discussion centring on the construction of syllabuses for the Certificate of Secondary Education examinations and the recommendations of the Newsom Report. The Secondary School Examination Council in its first bulletin on the C.S.E. has taken the cautious view: "Though teachers may want to move forward the terminal date of the course to one near or even after the pupil's date of birth, there is need for caution in stepping on to the more debatable ground of the present scene" (14). The Newsom committee took the bolder view: a study of the contemporary world should provide the natural climax to the history syllabus (15).

London and Cambridge have produced "O" and "A" level syllabuses respectively for recent world history. The London syllabus first examined in July 1964, has evoked enthusiastic interest, and an increasing number of schools are entering candidates. In the field of "O" level work it may be noted that Scotland is in advance of England, not only in the provision for twentieth-century study but also

in the integration of history with geography and economics in a comprehensive syllabus of Modern Studies (16).

The student who needs to be considered most fully in relation to this subject is the fifteen- or sixteen-year-old who will receive no formal education beyond that age. Nevertheless, it must not be too readily assumed that the older and more able student is capable of "looking after himself". If one accepts the advisability of instruction on the subject in the sixth form, one is faced with the alternative of pursuing the work for "A" level or as part of the general studies programme for all. It will generally be better for the history specialists to study an earlier period and for the whole body of sixth-formers to indulge in a fare of twentieth-century history with a good seasoning of modern political ideas and discussions on current events.

4. THE TRAINING OF TEACHERS

The difficulties of the teaching staff faced with the problems of handling the subject have been briefly alluded to above. We must now turn our attention to the needs of teacher-training in this field. The student's personal education can probably be quite well catered for by the university or college providing facilities for the student's voluntary use: a library well-stocked with periodicals and books, the encouragement of student societies, and the arrangement of lunch-time or evening lectures. It is difficult, of course, to make a sharp distinction between the personal and professional education of the student-teacher—every teacher should be alive to the world about him in order, if nothing else, to discuss intelligently and informally any questions posed to him by his pupils. The student-teacher requires in this subject as in others two kinds of instruction: an academic content and teaching method. History syllabuses at both universities and training colleges are gradually coming to incorporate contemporary history. A greater opportunity will be available when some training-college courses are reshaped to meet the requirements of the proposed B.Ed. degree. Is it too much to hope that the opportunity will be seized to provide courses in modern or political studies similar to the Oxford P.P.E. course for those teachers who would like to specialise in this kind of work? (17). With regard to teaching practice every encouragement should be given by tutors to students who wish to try their hand. So little thought has been given to the techniques of teaching the subject, so few aids are available that both student and tutor will benefit from bold experiments. And so, of course, will the schools when the students go out to them as fully-fledged teachers.

In teaching, a well-tuned enthusiasm kept safely below the pitch of discordant fanaticism, is in many ways a more valuable attribute than a well-stocked fund of knowledge. The transmission of this enthusiasm to succeeding generations of students, and in extra-mural work in refresher courses to practising teachers, is the tutor's gravest responsibility. Yet how many university and college lecturers are equipped to train teachers of contemporary history?—"Who will be found to develop (Contemporary History and Sociology in the training colleges) turns out to be a crucial question", writes Professor Tibble, "... and it is time we gave thought more to the *preparation* of members of staff for the colleges" (18).

5. CONCLUSION

In the last analysis it is the universities that must provide the lead. And is it too pompous to suggest that they have a duty to society, to the world indeed, to foster this kind of education? Many people have written in recent years of the need to think in global instead of class or national terms as a prerequisite for human, civilised survival. This is an educational problem, a truth glimpsed at by Walter Lippmann: "Much depends upon the philosophers", he has written. "For though they are not kings, they are, we may say, the teachers of the teachers. . . . It is through (the intellectuals) that doctrines are made to operate in practical affairs. And their doctrine, which they, themselves, have learned in the schools and universities, will have the shape and the reference and the direction which the prevailing philosophy gives it" (19). The philosophy that should imbue our teaching of history today is a belief in the essential unity of mankind. Only by accepting the understanding of the contemporary world as the prime aim of the history syllabuses of our schools can we hope to realise such an ideal.

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3. *ibid.*, p. 7.
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5. *Half Our Future: A Report of the Central Advisory Council for Education (England)* (1963). cf. paras. 201, 501-2.
6. *ibid.*, para. 499.
7. *ibid.*, para. 500.
8. E. J. King, *World Perspectives in Education* (1962), p. 14.
9. See E. H. Dance, *History the Betrayer: A Study of Bias* (1960).

10. H. Butterfield, *History and Human Relations* (1951), p. 170.
11. M. Oakeshott, *Experience and its Modes* (1933).
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13. Useful surveys of work already being undertaken in this field in Britain and other countries can be found in Parliamentary Group for World Government, *History Syllabuses and a World Perspective* (1962) and Atlantic Treaty Association, *International Affairs in Secondary Schools* (1962).
14. Secondary School Examinations Council, *Examinations Bulletin No. 1: The Certificate of Secondary Education* (1963), para. 205.
15. cf. especially para. 511.
16. The syllabus is printed in P.G.W.G., op. cit., pp. 24-28. The scope of this work can also be judged by reference to the books specially written for it: E. Wright and J. J. Tumelty, *Modern Studies* (3 vols) (1961-4).
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THE EFFECTS OF AUDITORY RHYTHMIC DISTRACTION UPON THE TASK PERFORMANCE OF EDUCATIONALLY SUBNORMAL CHILDREN

by D. G. LEWIS (*University of Manchester*)
and P. M. GREEN (*John Bradley School, Eccles*)

INTRODUCTION

AUDITORY distractions are perhaps inevitable under normal classroom conditions. Familiar noises such as lawn mowers, and activities from adjoining rooms, tend to be ignored by children who are interested in their work. It is unfamiliar noises, the unexpected rhythmical pattern amongst the monotonous beats, and the variation between noise and silence, which tend to alert attention and disturb concentration.

Some investigations of the effects of auditory distractions found no overall impairment of performance (Ford, 1929; Harmon, 1933; Miller, 1947). Whiteley (1934) on the other hand showed that music was a slight distraction to the process of memorisation. Tinker (1925) testing university students found that the performance of the more intelligent suffered most, though Hovey (1928) found little difference attributable to the intelligence of his subjects. Yet another view is suggested by the work of Mitchell (1949) who testing the reading achievements of American high school sixth-grade students found the more intelligent subjects to be stimulated, and so give an improved performance, by the distractions. A tendency for increased speed together with a higher rate of error was found by Fendrick (1937), Freeburne and Fleischer (1952) and Broadbent (1953). A further investigation by Broadbent (1954) showed that length of exposure to noise and individual tolerance were important factors in distractibility.

The effects of distractions upon the work of primary school children were investigated by Lilburn (1962). Tasks of copying, adding, memorising letter sequences and reading comprehension were all performed without any apparent detrimental effects. Brown and Clarke (1963) found that subnormals were less distractible than

severely subnormals, though a further study on subnormals (Brown, 1964) found no association between distractibility and intelligence.

Previous studies have therefore considered distraction effects on university and higher-grade students, on normal primary-school children, and on subnormal and severely subnormal children. Few investigations have been reported on the work of dull children however. In designing the present experiment it was thought that an intermittent rhythmic sound would be more likely to distract than a continuous sound, that a loud level of sound would distract more than a faint level, and that such distractions would tend to affect an auditory task to a greater extent than a visual one.

THE EXPERIMENT

Subjects

Twenty twelve-year-old children (17 boys and 3 girls) from a day E.S.N. school were chosen. Their I.Q.s ranged from 57 to 91, with a mean of 74.5. An audiometric test showed that all had hearing adequate to cope with the auditory test.

Tests (1) Visual Test

A cancellation test was selected to be within the scope of the least able child. It consisted simply of sheets of paper covered with mixed letters and numbers. The figure 0, which had to be crossed out, made up one-sixth of the total, and appeared in positions determined by tables of random numbers. The test was of 5 minutes duration.

(2) Auditory Test

A page of 24 pictures was provided, and the subjects were required to make certain marks (a line, tick or cross, with a red, blue or green pencil) alongside various pictures as instructed by the experimenter on a tape recorder. The same mark had to be made against a group of 15 pictures named in succession. There were six such groups in all, and the complete test took 5 minutes. The pictures were selected from Stott's (1962) Programmed Reading, Item 3.

Procedure

Each test was performed under five conditions as follows:

- Condition A: No distraction
- Condition B: Continuous sound, faint (65 decibels)
- Condition C: Continuous sound, loud (80 decibels)
- Condition D: Intermittent sound, faint (65 decibels)
- Condition E: Intermittent sound, loud (80 decibels)

Tape recordings of a beaten tambour provided the distractions. For the continuous distraction the same rhythmic pattern (lasting 4 seconds) was repeated immediately and continuously without variation. For the intermittent distraction different rhythmic patterns were beaten out at 20 second intervals. The experimenter's voice in the auditory test was fixed by a Dawes meter at 70 decibels from a distance of 6 feet. Marked concentration was then necessary to hear the instruction under conditions C and E.

The subjects were divided at random into two groups of ten, one group being assigned to each of the tests. Each child performed the test under each of the five conditions, the order in which the conditions occurred being determined by Latin Squares (Table I). As the order was different for each child, and each condition occurred once and only once on each testing occasion, practice effects were eliminated from differences among the condition mean scores.

TABLE I

LATIN SQUARES SHOWING THE SEQUENCE OF CONDITIONS FOR EACH CHILD

(1) *Visual Test*

Child No.	Occasions				
	I	II	III	IV	V
1	C	D	B	A	E
2	E	C	A	B	D
3	D	A	E	C	B
4	B	E	C	D	A
5	A	B	D	E	C

Child No.	Occasions				
	I	II	III	IV	V
6	A	B	D	E	C
7	C	E	B	A	D
8	D	A	C	B	E
9	E	D	A	C	B
10	B	C	E	D	A

(2) *Auditory Test*

Child No.	Occasions				
	I	II	III	IV	V
11	E	A	C	D	B
12	D	C	B	E	A
13	B	E	D	A	C
14	C	D	A	B	E
15	A	B	E	C	D

Child No.	Occasions				
	I	II	III	IV	V
16	A	D	C	B	E
17	E	C	A	D	B
18	C	E	B	A	D
19	D	B	E	C	A
20	B	A	D	E	C

RESULTS

The mean scores obtained by the groups under the different conditions, and also on each of the five occasions, are shown in Table II. We see that whereas the differences among the occasions mean scores are appreciable (and especially for the visual test), differences among the conditions mean scores are considerably less. The significance of these differences was investigated by an analysis of variance, the data from each Latin Square being first analysed separately in accordance

with the procedure advocated by Edwards (1950). For both tests the variance estimates for conditions did not differ significantly for the separate Latin Squares, and neither did the variance estimates for error. The data for the separate squares were therefore combined to give the analyses shown in Table III

TABLE II
GROUP MEAN SCORES FOR CONDITIONS AND OCCASIONS

(1) <i>Visual Test</i>					
Conditions:	A	B	C	D	E
	226.6	215.2	219.8	222.9	220.5
Occasions:	II	III	III	IV	V
	191.2	214.2	225.5	232.3	241.8
(2) <i>Auditory Test</i>					
Conditions:	A	B	C	D	E
	79.8	79.5	75.2	78.8	77.8
Occasions:	I	II	III	IV	V
	74.5	76.4	79.5	79.4	81.3

TABLE III
ANALYSIS OF VARIANCE

(1) <i>Visual Test</i>				
<i>Source of Variation</i>	<i>Sum of Squares</i>	<i>d.f.</i>	<i>Variance Estimate</i>	<i>F</i>
Conditions	703	4	175.75	< 1 N
Occasions	15,149	4	3,787.25	13.13 SS
Children	94,160	9	10,462.22	36.27 SS
Error	9,230	32	288.44	
Total	119,242	49		
(2) <i>Auditory Test</i>				
<i>Source of Variation</i>	<i>Sum of Squares</i>	<i>d.f.</i>	<i>Variance Estimate</i>	<i>F</i>
Conditions	138	4	34.50	1.17 N
Occasions	297	4	74.25	2.53 N
Children	7,851	9	872.33	29.66 SS
Error	941	32	29.41	
Total	9,227	49		

N—Not significant at the five-per-cent level

SS—Significant at the one-per-cent level

For both the visual and auditory tests differences among the conditions are not significant. We may conclude that the effects of distraction, rhythmic and intermittent, faint and loud, are sufficiently

small to be deemed due to chance. A practice effect is evident in both tests in that the mean scores for the later occasions tend to be greater than those for the earlier. For the visual test this effect is significant at the one-per-cent level, while for the auditory test it just fails to be significant at the five-per-cent level. Differences between children are, as could be expected from the wide I.Q. range involved, significant at the one-per-cent level in both tests.

DISCUSSION

While it may be argued that neither of the tests used in this experiment is very closely related to normal schoolwork, they do require a high level of concentration and the ability to respond to simple spoken instructions. The main result obtained is that in neither the visual nor auditory test is the performance significantly impaired by the distractions. Again no appreciable difference is apparent between the continuous and intermittent distractions, or between the faint and loud sound levels. Clearly the effects of auditory distraction are not as profound as is popularly assumed—at any rate as far as the simple sensori-motor and short-written types of tasks are concerned. In this respect the results are in general agreement with the conclusions reached by Hovey (1928), Ford (1929), Harmon (1933), Miller (1947), Freeburne and Fleischer (1952) and Lilburn (1962).

One further point may be made concerning the mode of analysis. The Latin Square design assumes that all interactions are zero, while in practice the interactive effects involving children may be expected to be considerable. A consequence of this is that in a mixed model—one which, for instance, involves as main effects both children and such “fixed” effects as conditions and occasions—the error term tends to be unduly small (see McNemar, 1955, 340-341), so that too many “significant” main effects can be expected. On the other hand, the evidence for the chance explanation of an *insignificant* main effect—that of conditions, in this experiment—is even stronger than the preceding analysis indicates.

A factor which almost certainly contributed to the main result of this experiment was the noticeably high level of motivation of all the subjects. The children were enthusiastic in setting about the tests, and all gave of their best. While it is gratifying to find that E.S.N. children can bring such a degree of concentration to their work it is also true that, in the experience of the experimenter (P.M.G.), this degree of concentration is not general. It is very possible that, under more usual classroom conditions, the auditory distractions might have

had a more arresting effect. We may justifiably conclude however that under suitable test conditions the E.S.N. child is able to concentrate upon brief performance tasks without deleterious effects from rhythmic distraction.

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EXPLORING THE ENVIRONMENT

by PAUL WIDLAK
Remedial Teaching Service, Wolverhampton

I. INTRODUCTION

THERE is an ever-increasing quantity of research in education and precious little of it ever seeps down to the roots, the classroom. The Remedial Teacher is well fitted by training and opportunity to act as an intermediary between the theoretician and the "practical" man (the man who is ignorant of the theory upon which his practice is built?). The writer recently had such an opportunity: of teaching a small group of highly intelligent children in the fourth year of a local primary school, for one afternoon a week over a period of about eight weeks, within an experimental syllabus. There had been a discussion of environmental studies at a Local Education Authority course for head teachers and it was hoped that some data might be obtained about possible approaches. Some felt that the Black Country environment was not a profitable area of investigation: like the maidens in Pound's *Pan is Dead* (1959) they asked:

There is no summer in the leaves,
And withered are the sedges;
How shall we weave a coronal,
Or gather floral pledges?

One point seemed clear; it must be a planned exploration of the environment, to be really effective in a school setting, and not only for reasons of economy of time and teacher's salary. We perceive more, we perceive better, when we know what to look for. By looking at the same thing from successive points-of-view—mainly the school garden and local buildings—the children saw more and saw it better. Vernon (1962) made this clear:

The more intelligent individual at least can learn to modify his manner of perception according to circumstances. Thus, although in general his perceptions may be quick and rather superficial, in certain particular situations he learns to search carefully and attentively and to study closely, and to select particular details for examination irrespective of the whole field of view of which they are a part. One of the functions of education is to teach the ob-

server how to do this; and if he has not been taught, we must not blame him if he is inefficient in this type of perception.

This was certainly a point kept in the forefront of the present study, but in the development of this kind of close-scanning operation, there was a blurring of the edges of traditional disciplines; and this seemed to offer a chance to strike a blow for unity within diversity—to explore the environment not only physically, but also by moving about within and between disciplines, to encourage creativity without reference to traditional, subject-orientated divisions. We are always being urged to do this in primary schools and occasionally one observes it in action, but teachers have themselves to swim against the tide of their own training to achieve such inter-disciplinary buoyancy. The “best” primary schools, moreover, keep a very sharp eye indeed on the grammar school selection examinations, with consequent narrowing of the syllabus, not only into subjects but into examinable skills, descending even to training in the techniques of filling-in intelligence tests. It seemed well worth while to give this small group of potentially high-creatives as wide a range as possible, hoping that perhaps some fusion of the disparate elements might occur.

There were theoretical grounds for supposing that this might be so. Bruner (1962) has defined creativity as effective surprise; after discussing three types of effectiveness, all of which were “the resultant of combinatorial activity”, “a placing of things in new perspectives”, he began to feel that the forms were perhaps not so separate as he had argued. At first he had identified, for example, formal effectiveness (especially revealed in mathematics, logic and music) and metaphorical effectiveness (particularly effective in Art); later, he felt that though the *product* of science was not metaphorical, the *process* seemed shot through with the metaphorical at critical moments in the history of science.

Again, Piaget (1926), in one of his early formulations, distinguished directed or intelligent thought, from undirected or autistic: the one conscious, adapted to reality, admitting of empirical or logical truth and communicable by language; the other subconscious, not adapted to reality, but creating for itself a dream world of imagination, tending not so much to establish truth as to satisfy desires, working chiefly by images and evoking by means of symbols and myths the feeling by which it is led. Water, for example, can be analysed and observed, its behaviour systematised, its motions reduced to laws; or it can be drunk, or used to symbolise birth and regeneration, as in Baptisms—autistic usages. It was clearly desirable that thinking

of both kinds should be encouraged; and the end-result would very likely cut across the traditional arts/science division.

2. THE CHILDREN'S WORK

We began by considering Shape. The children drew some Car-diods and other of those straight line figures which eventually give a curved outline. Even in Mathematics, Shape could be fluid; the same Shapes could sometimes occur in Nature and we would expect greater variety within the symmetry. They were shown diagrams of spirals originating in dreadful logarithmic fastnesses and asked to find natural objects having similar characteristics: they found whelk shells, worm casts. Ravielli's *Adventure with Shapes* and Frank Land's *The Language of Mathematics* were much used, at this and later stages. We then made some simple models of polyhedra starting with a tetrahedron and ending with an icosahedron. This led to a discussion of the importance of triangles as constructional units and they were asked to collect examples; they observed and drew a pair of steps, a church spire, roofs interior and exterior, a climbing frame, a fire escape. They calculated the areas of the polyhedra they had made, using a formula induced from their knowledge of rectangles; they moved on to study the relationship between faces, vertices and edges of polyhedra and arrived at Euler's theorem ($F + V - E = 2$). The collection of interesting shapes now included a necklace of shells woven by the sea, cylindrical, triangular and circular pebbles, inflorescent flowers. We found out about the sequence of numbers known as the Fibonacci Sequence and they counted the florets of a ragwort; this was not successful, though as one of them recorded: "If we could have found a common daisy, we would have found that the total of florets would be a member of the Fibonacci Sequence." Buildings were examined: they knew about axes of symmetry and learned what the Golden Section was. Techniques for measuring inaccessible objects were tried out, trees and the school itself being measured, using the well-known methods based on the properties of similar triangles.

Simultaneously, scientific aspects of similar materials were being drawn out. The children were presented with information on soil formation, the atmosphere and weather, by means of three linear programmes, Thornhill's *Earth in Orbit* and two specially written for this experiment and presented on an EsaTutor machine. The children liked these and there seems a profitable field here for programmers. They went quite a long way through Thornhill and quickly mastered the sections on longitude and time, and on daylight saving; some even

managed the rather dense section on satellites and time keeping. They also learned well from an expediency programme on *Weather*. This presented information about the constitution and function of the atmosphere, and made a particular point of referring the pupil to experiments (like the one where a thin-sided can is heated until it collapses), the results of which were incorporated in the programme.

In this and other work, they were encouraged to observe first and then to interpret. They made a study of cloud formation, first identifying the different types from suitable books, noting the weather accompanying different clouds, then attempting to explain the nature of cloud formation, relating pressure and temperature, and trying to account for hail, rain, lightning, winds and so on.

They were asked to bring as many examples of soil as they could. They observed the effects of drops of water on each and drew up lists, differentiating absorbent from less absorbent:

1. Ash garden soil very fine. Absorbs slowly.
2. Black garden soil, absorbs moisture.
3. Fine gravel collected from Aberystwyth, absorbs moisture.
4. Red sandy soil collected from a building site, absorbs water slowly.
5. Fine sand collected from Barr Beacon does not absorb much water.
6. Mortar from window absorbs quickly.

They each worked through a programme on *Water and the Land* (again incorporating experiments) which told them something about the effects of rainfall, showing how erosion occurred and the antidotes adopted, such as ploughing along the contour instead of up and down a hillside.

Much of this material was later used in a corporate Science Fiction story of some merit. In among the Green Creatures of X-Lon and their adventures were such passages as:

Looking out through the porthole, I noted that the sky had turned black. At first I wondered but then I remembered that certain molecules pick up blue light and that there are more of these molecules nearer the earth than far away so that when you get very far up there are none of these molecules at all and the sky goes black.

Programmes *need* not kill creativity, it seems. (Hilgard, 1964.)

While we were studying clouds, the writer suggested that it would be a good idea if someone wrote poems about them. There was much horrified protest, but a few made an attempt, then they were shown

some books of children's verse and Lawrence's *The Snake* was read to them. No other instruction was offered. Here is a selection.

SKY

The clouds are rolling and glowing
 The sun is shining, unseen.
 Big black clouds appear—foreboding—
 They look like mushrooms floating.
 Now a blue patch is suddenly there
 Like a spotted blue apron
 My mother might wear.

BUTTERCUPS

I can see a patch of buttercups
 Bright yellow buttercups,
 They look so dainty on their stalks,
 Holding their proud heads up.

A DEEP, DARK HOLE

A deep dark hole
 Was lying near some trees.
 The grass is sharp and tall
 The soil is sand, and mud.
 Down the hole is litter.
 The iron spikes are wobbly
 And rather bent and rusty.

SMALL, CROOKED STEPS

Small crooked steps
 By a lonely wall and tree;
 At their head
 A small overgrown path
 Surrounded by gardens where lupins grow,
 And the tall delicate grasses
 Wave gently in the wind.
 The path meanders like a river,
 Comes to a clump of sycamore trees.
 A heavy intoxicating scent
 Hangs in a calm pocket of air.
 Boughs covered thickly in foliage
 Sway dreamily in the breeze.

Occasional lines made use of material gathered under other heads:

The grass is sharp and tall,
 The soil is sand, and mud.

Elizabeth produced a poem based on her recollections of Gerald Rafferty's book:

Snow Cloud Stallion was his fine name
His nostrils quivered
His beautiful hindquarters moved; he was off
Danger threatened the herd.
The stallion went to meet his foe.

Elizabeth was familiar with horses in her own right, as the third line shows. A little later, autistic use is made of the material, by this very quiet, eager-to-please child:

Snow Cloud reached the jugular hold first
With a blood-curdling scream the Black Stallion fell dead;
Triumphantly he took his mares,
They galloped away into the mist to join the herd.

An awareness of the point beyond which one's presence is an intrusion ought to be developed. "Certain moments in creative work resemble the last step after arrival at the top of a mountain, and that last step is flight." (Burns, 1956.) Simone de Beauvoir (1963) recollected her own ten-year-old self, the "immensities of the horizons which opened themselves before my curious eyes. I explored them all unaided; the mediation of grown-ups no longer interposed a barrier between the world and myself."

3. CONCLUSION

An attempt had been made to educe work that might help the pupil to see the environment in fresh ways, and leave him, perhaps, with a feeling for "combinatorial activity", for the poem in the clouds and the maths. in the plant. There was evidence, even within the modest dimensions of the present study, that data might be used to evoke a variety of responses which need not fall within traditional subject-matter divisions. The children were as interested in the "scientific" as the "artistic" or "mathematical" material; the mutual *antagonism* between science and arts was not present in these primary school children. The children wrote, calculated and thought without worrying at all about the supposed difficulties of the subject matter. This approach to environmental studies definitely reduced the anxiety-load carried by such words as "arithmetic", "science", "composition", without any sacrifice of standards.

Brookes (1964), working with much older students, related how, at the end of his course for engineers, the student felt, usually for the

first time in his life, a desire to write: "at last he feels that he has the only possible justification for writing—something to say. And he begins to have a respect for those who can write well" . . . "the study of 'communications', the modern hob-nailed substitute for Day Lewis's 'magic', could, if we wished, make poetry and science one again". Clegg (1964) has shown that children can write clearly and attractively about a diversity of subjects—a chestnut twig, a tapeworm, coal-gas, Philip II of Spain, a visit to a pond, a coal-miner, a personal experience—without employing different techniques of writing. He felt that "in most good Primary Schools" no distinction was made between "Recording" English and "Personal" English, so that the ability to use words well became "an indivisible achievement", applicable to any piece of work the child did. The present study provides further evidence that he was right.

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BOOK NOTICES

L. PEARCE WILLIAMS, *Michael Faraday* (London, Chapman and Hall, 1965, pp. xvi + 531, 70s.).

MICHAEL FARADAY was a very great experimental scientist, arguably the greatest in the history of science. He was also a non-mathematical theorist of unquestioned fertility who laid the foundations of field theory. His scientific genius was accompanied by great tenacity of purpose and a religious attitude to life. Moreover he was largely self-educated and began his working life as a book-seller's errand boy. The story of his rise to eminence has often been told. He helped to create the classical picture of the man of science as a disinterested seeker after truth, unselfishly exploring the physical universe and exhibiting the beauty and simplicity of its laws.

Professor Pearce Williams, of Cornell University, has written a very long and careful study both of Faraday's work and Faraday the man. Of course the work predominates, not only by virtue of its extent and importance but also because for Faraday work occupied so large a sector of life. The book is therefore *inter alia* an important contribution to the history of electro-magnetism and electro-chemistry in the nineteenth century. Those who are unaware of the contributions of Volta, Davy, Oersted, Ohm, Ampère and Faraday during the first half of the nineteenth century have missed a fascinating story and also lack knowledge of some of the highest intellectual endeavour in the scientific field. Here was a period of vast importance when a whole new sector was opened up and one which was to transform man's idea of physical forces and substance. Like other periods of scientific ferment it contains numerous examples of spite, envy and quarrelling over priority. There was misunderstanding too and even some of Faraday's most fruitful ideas were regarded with amused tolerance by his friends, though later they were assessed at their true value by Clark Maxwell and Kelvin.

The skill with which Professor Williams deals with a vast range of material is as impressive as his thoroughness. Faraday was a Sandemanian—a matter of importance in his life—and the author gives a succinct account of the origin and beliefs of the sect; we have a long and valuable chapter on the influence of Kant, Coleridge and others on Faraday's philosophical views; and, perhaps of greater interest to readers of this journal, we have Faraday's views on education. These views are worthy of attention to-day not only because technically Faraday was a brilliant teacher but because they were consistently based on a laudable ideal. For him education was self-education and founded on humility. If he seems to have assumed a

general faculty of judgment it must be remembered that he regarded judgment as a quality to be acquired and used consciously, almost as a sacred duty.

His advocacy of science was eloquent and forceful. In a striking passage he said:

The beauty of electricity, or of any other force, is not that the power is mysterious and unexpected, touching every sense at unawares in turn, but that it is under law and that the taught intellect can even now govern it largely. The human mind is placed above, not beneath it; and it is in such a point of view that the mental education afforded by science is rendered supereminent in dignity, in practical application and utility; for, by enabling the mind to apply the natural power through law, it conveys the gifts of God to man.

The history of science is accorded scant recognition in this country and its potentialities as a means of educating undergraduates often go unrecognised. Though scholarship is supra-national it is astonishing and slightly humiliating that, for example, the standard work on The Lunar Society of Birmingham should have been written by an American scholar. Here again in this book we are greatly indebted to American scholarship for a massive study of the work and life of a British man of science.

W. J. SPARROW

R. D. ARCHAMBAULT (Ed.), *Philosophical Analysis and Education* (Routledge & Kegan Paul, 1965).

THIS book is of considerable importance in the development of philosophy of education in Britain. It represents the renewal in this country of philosophic interest in education after a lapse of some thirty years since Whitehead's and Russell's first writings on education, a period in which significant work in philosophy of education has been confined largely to the U.S.A. It confirms the view, earlier advanced by Hardie and O'Connor, that education is a worthy field of study for academic philosophers. And, in giving examples of detailed treatments of detailed problems, it serves as a signpost to future workers in this field.

A group of nine professional philosophers, of whom four are actively involved in teaching philosophy of education, examine the nature of educational theory and practice, discuss the contribution that philosophy can make to education, and subject university education and the teaching of philosophy itself to philosophical analysis. The essays by practising philosophers of education—Reid on "Philosophy and the Theory and Practice of Education", Peters on "Education as Initiation" and Hirst on "Liberal Education and the Nature of Knowledge"—will probably be found of special interest and value to those engaged in an advanced study of education and in teacher training; while the other essays may prove of particular value to those students, and teachers, of philosophy who are interested in education. The more general essays, which include Griffiths'

"A Deduction of Universities" and Atkinson's "Instruction and Indoctrination" are fully relevant to the aims of this volume. But if philosophy of education is going to concern itself less with broad, sweeping topics such as aims and values in education, and concentrate on the patient analysis of concepts and language, on the elucidation of concrete moral problems in education, on the discussion of detailed aspects of curriculum and method from an epistemological point of view, the practitioners of philosophy of education will need the sort of insight into educational problems that can be gained only from a combination of theoretical study and practical experience in education.

In a book that contains so many good things, the occasional dogmatic and unphilosophical statement—such as Peters' recommendation that "If teachers are not convinced of this (i.e. Peters' definition of education as primarily initiation) they should be otherwise employed" (p. 107)—while surprising, may be forgiven. *Philosophical Analysis and Education* will undoubtedly promote stimulating and beneficial conversation amongst students and teachers both of education and of philosophy.

S. MORRIS

DORA E. WHITAKER, *Mathematics Through Discovery* (Harrap Vols. 1-3, 5s. each. Teachers' book 9s. 6d.).

It is not a new idea that children should discover mathematics; but it is an idea which has gained a new impetus since Piaget's investigations showed that children up to the age of twelve or thirteen learn and understand primarily through their activities.

The experiments and exercises in Miss Whitaker's book (devised with the aid of children) provide a framework for an approach to learning in which children do, discover, see relations, and use their results. It is no more than a framework, for once children acquire this attitude to mathematics they themselves provide fresh problems to be investigated; but it is an extensive and varied outline likely to lead to profitable inquiries.

Throughout the three pupils' books numbers are introduced in relation to each other and their uses; e.g. 9 with square feet and square yards, 7 with weight in stones, etc. Attention is drawn to relations between operations, e.g. addition and multiplication, subtraction and division, as well as to some of the many patterns which numbers make. Measures are introduced in practical work; and it is pleasant to find that in Book 1 children are already calibrating jars to measure volumes, and that they even employ a piece of balsa wood as a kind of hygrometer in liquids of differing densities. Block graphs and elementary geometrical ideas are also used at this stage. In the later books the idea of fractions and decimals are developed, including that of very small fractions, using rulers and graph papers. The metric system is used in measurement and in map reading. Scales, with harder areas and a variety of worthwhile work with plane figures and solids

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are included in Book 3; yet there is still time for rates of exchange and percentages.

The introduction of line graphs, though obviously valuable, seem somewhat abstract in approach; it comes from relating pairs of x and y values instead of through conversion graphs or connexions between ages, for example. And the historical introduction in the first few pages of Book 1 will not be palatable to everyone. But since the books are primarily guides to action, it is a simple matter to make replacements or to adapt methods to suit other tactics either of teachers or pupils. In any case, these books will be a valuable aid to teachers or to parents who wish to introduce mathematics as enjoyable, a useful tool in life and a living subject.

R. BEARD

W. R. NIBLETT (Ed.), *How and Why do we Learn?* (Faber and Faber, 1965).

THIS book contains the text of a series of lectures given in the University of London Institute of Education during the session 1963-4. The book is in two parts. The first part comprises contributions from six leading British educationists who take up different aspects of the main theme. Professor Wiseman contributes a general survey of the state of research in learning and teaching. The fact that we are only just beginning to tackle the problem of human learning and have hardly begun to investigate the how and why of good teaching, has inevitably meant that his remarks mainly raise problems for investigation rather than reports of findings that might be of immediate value for teachers. He does, however, discuss the relevance of current research to teaching and his audience must have found this interesting and stimulating. Dr Taylor deals with the social aspects of learning and teaching and has some very apposite comments to make on the social structure of English schools and their relationships with the communities they serve. Other lectures deal with the use of teaching machines for group instruction; problems of perception, intuition and insight; group work in school; and an outline of what is known about the way children's thinking develops. The contributions make a heterogeneous collection which lacks a unified viewpoint. As inspirational lectures aimed at stimulating thinking they were probably successful, but as a systematic exposition of the material one might expect to be subsumed under the title of the book they are less valuable.

The second half of the book, as the editor suggests, "seems to have but a tenuous connexion" with the first half. It has indeed, and it is difficult to see how the contributions of Professor Hoggart, Sir Hugh Foot and Mr Stephen Potter which are often anecdotal and irrelevant to the theme of the book are expected to be of value to the reader seeking enlightenment in the field of human learning.

Probably the great difficulty with a book having this title, however, is the paucity of material on the subject. Educational research in the past has been so concerned with measuring what children have learned or attempt-

ing to predict which children are likely to learn best, that precious little time has been spent on investigating *how* children learn. Perhaps one of the main merits of the book is that it makes this fairly clear.

E. STONES

J. S. MACLURE, *Educational Documents England and Wales 1816-1963* (Chapman and Hall, 1965, pp. 307).

THIS book brings together some fifty excerpts tracing the development of education in this country, as seen from their "commanding heights" by policy-makers and official advisers. As the compiler, an eminent educational journalist says: "any [such] selection must tend to be arbitrary and idiosyncratic"—but this one should be found very serviceable by many users. Matthew Arnold, H.M.I., on "payment by results"; Balfour introducing his 1902 Bill in the Commons; the Hadow Report, 1926, and the Robbins Report, 1963, on, respectively, the average and the ablest young members of our society; all these and many others are represented by what are arguably their crucial passages. Progress, and slowness thereof, in technical education, gets a good share of attention. And those who fear that these excerpts will too often be used by students as substitutes for the parent-sources themselves, might also reflect that many who would otherwise never go to the original publications, will be led to them by this handy collection.

I.A.A.M., *The Teaching of History in Secondary Schools* (Cambridge U.P., 3rd edition, 1965, pp. 202).

EXTENSIVE changes have been made in the new edition of this indispensable manual for new and old history teachers in—primarily—selective secondary schools. It is as lucid and down-to-earth as ever, though concerned relatively more with the principles rather than practices of history teaching. Thus the four chapters, totalling 90 pp., in the previous editions on methods of history teaching, have been boiled down to one of 30 pp., and the didactic chapter on the history room has gone, though some of its matter has been usefully retained elsewhere. The slight shift of emphasis does not make it any less desirable for the young teacher, or teacher-to-be, to buy this book for constant use, and it is therefore a pity that he may be discouraged from doing so by the stinging increase in its price: 30/- as against 17/6 for the 1957 second edition.

In general, the merits of this "Memorandum", in the quaint phraseology of the preface, are too well known and appreciated to call for much critical discussion, and if at times it seems to elaborate the obvious, this reviewer would hesitate as to where to draw the line between the obvious and the worthwhile in this field. Reconsidered after fifteen years, it duly takes into account recent changes in the approach to history in schools by discussing, e.g. "national history and its alternatives" or expanding a few scattered

passages into a whole chapter on "History outside the classroom"; and it does not neglect new trends in the *ethos* of work, or in the sociological aspect of secondary schools, by devoting a chapter to "Tests and examinations", and by bearing in mind the recent expansion (some would say, dilution) of sixth forms. The list of the sizeable Committee of authors (a pity, perhaps, that the collaboration of a couple of teachers from university History Departments was not secured), itself provides a comment on the current situation in the history teacher's market: half the members moved posts during the three years it took to prepare this book. But it is none the worse for it, and should go a long way towards remedying the impression which elicited the rueful, if exaggerated, assessment by one member of the Committee: "in no other subject is there so much teaching and so little learning".

R. SZRETER

JOSEPHINE KAMM, *Hope Deferred* (Methuen, 35s.).

THIS is a useful book, for until its publication there was no sound, general history of the education of girls in England available. In future those who wish to study the subject will know where and how to begin, and, through following some of the references which Mrs Kamm gives, they will be able to pursue their studies to greater depth if they wish. It is also an interesting book, for the narrative is supported by a delightful collection of quotations and examples, and it is valuable in that it demonstrates forcibly some of the disadvantages and humiliations to which girls have been exposed. Perhaps their status reached its lowest level in the marriage-market competition of the eighteenth and nineteenth centuries, when they were expected to do their husband-hunting in circumstances which precluded friendship between the sexes, and when female education imposed intellectual and moral inferiority upon women.

It is perhaps appropriate that the adjective "feminine" comes to mind as a just description of a book on the history of girls' education. But it is a corollary of the inferior status of women that the word has a pejorative meaning, and it is the weaknesses of the book, not its virtues, which bring the word to mind. The old-fashioned criticism of women accused them of being personal and gossipy in their assessments of issues in which this approach is not valid, and one of the faults of "Hope Deferred" is that the first part, covering the period from Anglo-Saxon times to the seventeenth century, is composed almost entirely of biographical fragments on great ladies, subject-matter which leaves the reader with the hungry feeling that most of what he would like to know has been left out. There are at least three other books on women's education in England which adopt the same irritating and distorting approach. Is there no other material available? Is there no way of wringing significant answers out of the evidence?

One of the reasons for adopting the biographical method is that only a historian trained in the techniques of studying the earlier periods of our history can deal with the material in a more profound and professional man-

ner. The scholars who have colonised this territory have laid many pitfalls for unwary interlopers, and Mrs Kamm falls into some of them. For instance, she makes such impermissible statements as that "among the innovations which followed the Norman Conquest was the introduction of feudalism", and she gives the impression that the monasteries played a large part in feudal education, whereas it is established that education was a diocesan, not a monastic, concern.

No one can be an expert on every period of our history, and, as one would expect, the narrative of *Hope Deferred* gains confidence and strength when it reaches the nineteenth century, the home ground of the author, and on this period in particular it contains a quantity of thorough, clear, and well-arranged material.

One wishes that the book contained more tough-minded sociological theory to define exactly what the charming extracts and examples illustrate. The educational progress described seems to take part in a void, without relationship to the rest of history, and without any external causation. No reason is suggested to explain why schemes for women's colleges and schools appeared for the first time during the seventeenth century; how were these related to the Puritan Revolution? To the ideas of Comenius? When and why did the practice of arranging marriages between young people who were still children give way to the free choice by young men, and what effect did this have on girls' education? There is only a brief

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reference to the increasing idleness and frustration of middle-class women in the nineteenth century which led finally to the feminist movement; no use is made of the economic explanation for this which can be found in the classic work of Ivy Pinchbeck, nor are we reminded of Thosten Veblen's brilliant analysis of upper-class women's function in a society which had no use for their work.

This curious failure to recognise relationships between education and other social and historical factors is perhaps the reason for the author's helplessness before contemporary issues. She has no point of reference, no philosophic convictions for judging the Newsom controversy, and her treatment of it amounts only to a colourless synopsis of a few opinions.

S. JULL

G. L. BROOK, *The Modern University* (André Deutsch, 25s.).

"NO ONE", wrote Thomas Arnold, "ought to meddle with the universities, who does not know them well and love them well." This dictum is equally true when we substitute the words "write about" for "meddle with". Professor Brook is a writer with an informed and critical love of the modern university. He prefers the name "modern" to other, frequently used, adjectives such as provincial, civic or Redbrick. This book can best be compared with "Bruce Truscot's" *Redbrick University*, but it is free from the pomposity that is associated with that once anonymous author. Professor Brook writes with insight and humour, and it may be that those who read this book in advance of their colleagues will be able to acquire a reputation for astringent, witty comment upon university life and manners. It is to be hoped that the wide audience which this book deserves will soon correct such reputations. This audience should include university teachers and administrators, parents, graduates, and politicians. Undergraduates could also profit from reading it, though it seems likely that the chapters on "Students", "Lectures and Tutorials", and "Books" will prove closer to their immediate concerns than those on "The Purpose of a University", "Entrance Requirements", "Professors and Lecturers", "Academic Freedom", and "Expansion".

No writer on universities can be entirely free from subject bias, but it is only on a few occasions that one comes across an approach that a scientist would have modified. The comments on admissions policies will repay careful attention by school teachers, although they might dissent from the judgment: "The variety of entrance requirements gives a greater freedom to schools to experiment; schools which find the entrance requirements of one university irksome are free to send their pupils to other universities" (p. 148) on the grounds that it is an over-idealised standpoint. Lecturers will find some of the judgments to be typically professorial, but not to be discounted on those grounds.

The reviewer feels that the chapter on the purpose of the university could have been expanded. The author states that his consideration is

carried out "in the most general way" and that "few are the assumptions about universities that can count on general acceptance". If we are to be more than a pale reflection of modern society, must not the members of the modern university devote more attention to asking what responsibilities are implied by academic freedom, what is meant by graduate status, what the university community is, and what are the real values by which the universities (and thus by implication an educated, technological society) must live? Notwithstanding these criticisms, this is a welcome and stimulating book.

B. G. GOWENLOCK

INFORMATION FOR CONTRIBUTORS

The *Educational Review* publishes three times a year general articles and accounts of research of interest to teachers, to lecturers, to research workers in education and educational psychology and to students of education. Articles dealing with research, with descriptions of experimental work in schools, with critical reviews of teaching methods or curricular content in schools will receive special consideration. In addition, the Editors will accept from time to time articles on administrative problems, on tests and measurement, on child growth and development and on the relation of schools to the community.

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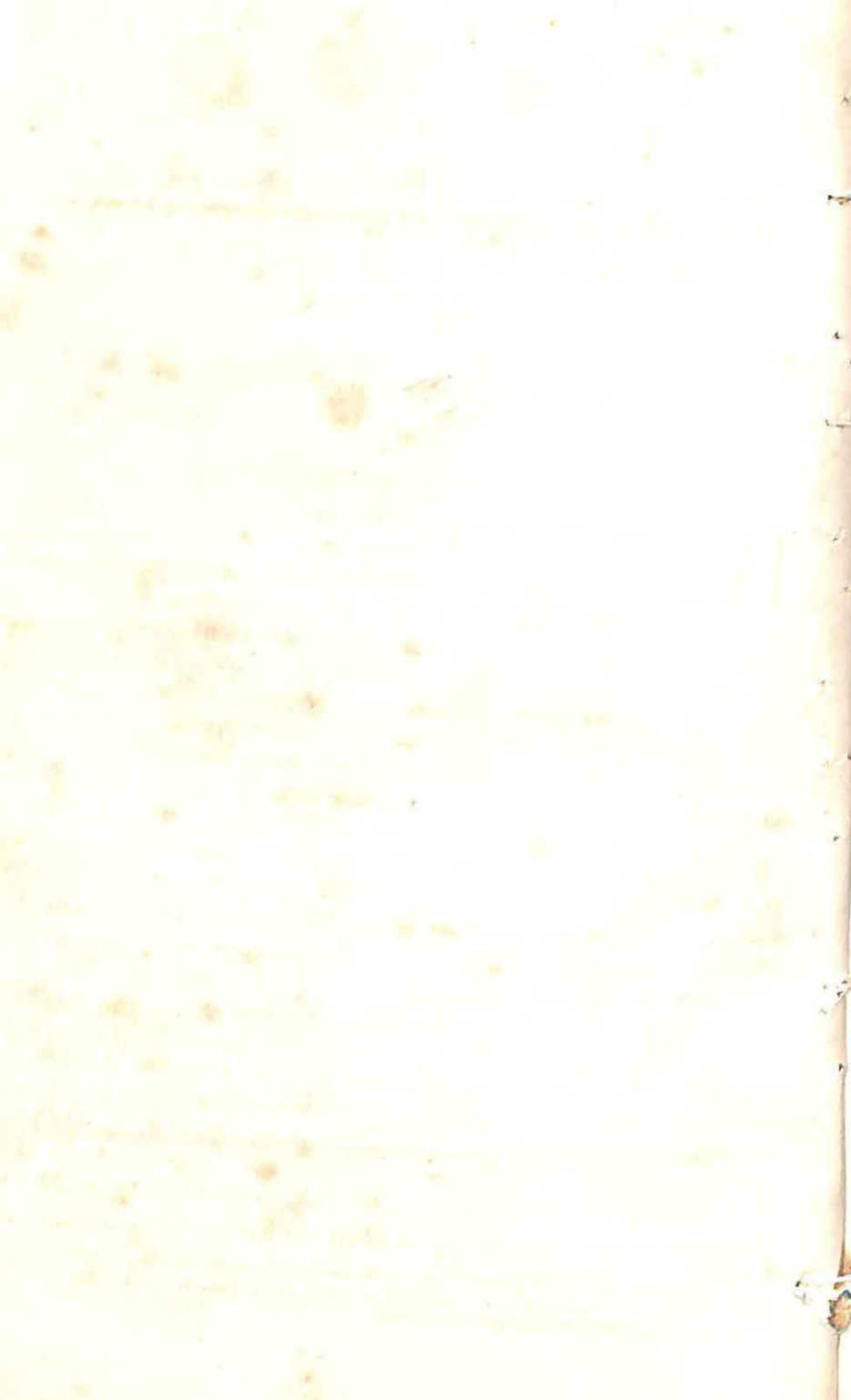
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INSTITUTE OF EDUCATION
UNIVERSITY OF BIRMINGHAM



EDUCATIONAL AND INTELLECTUAL DEVELOPMENT AMONG CANADIAN INDIANS AND ESKIMOS

by PHILIP E. VERNON

*Professor of Psychology,
University of London Institute of Education*

PART I

I. INTRODUCTION

By studying the attainments and abilities of children who have been reared in unusual cultural environments, it should be possible to bring out more clearly the influence of environmental factors on mental development (Vernon, 1965). The writer is engaged on a series of cross-cultural comparisons in which the same 4-5 hour battery of tests is given to samples of boys aged around 11.0 years and the scores are related to observations and assessments of their major environmental handicaps. The tests are designed to cover a considerable range of abilities; and it is the pattern of scores along different lines rather than the overall level or general intelligence which is of interest. In all the samples, English is the medium of school instruction so that, by 11 years, the boys can understand instructions, particularly since most of the tests are given individually. But their mother-tongue is not necessarily English, and obviously the linguistic background is one of the most important factors in performance, at least on verbal tests.

During January-April 1965, the writer was attached to the Education Department, University of Alberta, Calgary, and through the kindness of the local Superintendent of Education for the Department of Indian Affairs, was able to visit schools in two nearby Indian reservations, one for Stoney Indians at Morley and one for Blackfoot Indians at Cluny. Forty boys were tested and interviewed. In addition, through the good offices of the Education Division of the Department of Northern Affairs and Natural Resources in Ottawa* and

* Grateful acknowledgments are made to the Department for financial assistance, and to the Association for the Aid of Crippled Children (New York) which is supporting the whole series of researches.

their staff in the Northwest Territories, two weeks were spent at Inuvik, Tuktoyaktuk and Aklavik, working with 50 Eskimo pupils in the Mackenzie Delta, on or near the Arctic ocean. In this article, the first of two, a brief sketch will be given of the history and present position of the Canadian aboriginal peoples, and a survey of these samples, drawing attention to the main factors of educational and psychological interest.

2. HISTORICAL-ECONOMIC BACKGROUND

There are roughly 190,000 Indians and 12,000 Eskimos in Canada, though any estimate must be imprecise because of considerable interbreeding with whites. They are thought to be originally of Mongolian stock, their ancestors having crossed the Bering Straits between the last ice age, 20,000 B.C., and 3,000 B.C. (Jenness, 1963). They came in numerous waves and spread out over the American continent, forming a number of subcultures largely distinct in their economies, customs and languages. The Eskimos were presumably the last wave, and they remained in the north, mostly above the Arctic circle, though spreading over the 4,000 miles from Alaska to Greenland.

The impact of white civilisation on these stone-age people was catastrophic. It brought many amenities such as the horse, the wheel and the rifle, but it also brought diseases and drink, which exterminated thousands. The virtual extinction of buffalo and caribou destroyed the traditional livelihood of many tribes and led to widespread starvation. In his determination to exploit the natural wealth of North America, to cultivate, to build up his towns and trade, the white man callously disregarded the needs of the aboriginals, fought against them when they objected, and eventually herded the remnants into reserves on such land as was no use to him. In Canada there was, in fact, little warfare, and peaceful treaties were signed ensuring that Indians would be wards of the Crown on their reserve lands within the provincial boundaries. Some tribes took to ranching, farming or trapping, but with the breakdown of their natural hunting economy, demoralisation ensued, and to a large extent they exist on reservation funds and social welfare allowances. Many other Indians, loosely referred to as Metis,* together with the Eskimos, were left free to eek a living from hunting, trapping and fishing in the northern parts of the provinces and the vast Northwest territories. But in the twentieth century, the fur market fluctuated so violently that even

* More strictly, Meti means a half-breed of partly French descent.

this source of income ceased to support more than a fraction of the population. Many have moved into white settlements or trading centres and become hangers on, apathetically expecting the white man to provide.

However, this sorry story was mitigated to some extent by the efforts of humanitarians who gradually awakened the public conscience of white Canada to the plight of the aboriginal peoples. Increasingly, therefore, the federal and provincial governments have been pushed into attempts to relieve the situation. But official policy has vacillated, and there is no easy solution. Often it would appear that politicians and civil servants, working thousands of miles away in Ottawa, have merely done their best to avoid trouble and keep things quiet. Others have preached the maintenance of the aboriginal peoples' natural way of life, community development, and the building up of native crafts and trades. Admirable as these are, they only touch the fringe of the problem. Many others believe in progressive acculturation and integration with the white culture, and this process has indeed gone much further among the corresponding peoples in the United States (Macgregor, 1946), Alaska and Greenland (Jenness, 1964). Some reserve Indians, Metis and Eskimos have indeed moved to centres of employment, but they are commonly regarded as untrustworthy workers, not because there is much racial prejudice, but because of their improvidence, instability and tendency to drunkenness. Thus, with rare exceptions, they tend to become a depressed class of casual labourers and unemployed, in the slums of the big cities. For the same reason, efforts to set up mining, building, trading, whaling or other industries in the Indian and Eskimo territories have had but a limited success, although the few non-whites who do obtain steady wage-earning employment are said to make good mechanics, labourers, etc.

3. VALUES

It is obviously dangerous to generalise about the psychology of such different peoples as the prairie Indians, the Pacific Coast fishing tribes, the Eskimos, and others. Nevertheless they seem to have shown in the past some outstanding common characteristics which help to explain the present. In primitive hunting societies the fundamental units of social organisation were the nuclear family, and the small band of interrelated families. The products of the hunt were freely shared among members of the band, and there was no point in conserving for the future. All would feast on what was available now,

believing that, from the unlimited resources of nature, other kills would be made before long. Likewise time was freely available for making weapons, utensils, decorations, etc., and for enjoyment, when not employed on the chase. In so far as property was recognised, it applied to a man's names, songs, dances and spirits rather than to his material possessions. There was no organised legal system, nor allegiance to outside authority; decisions were generally based on informal consultations among heads of families. A man achieved status in his group by his skill in hunting, and—in the case of the more warlike Indian tribes—his bravery and leadership in fighting. (The Eskimos were always too scattered, too occupied in wresting a living from the Arctic, and too easygoing, to indulge in warfare.) Naturally, therefore, the aboriginal does not adapt readily to the Puritan ethic which stresses work as a duty, competition rather than co-operation, the virtues of acquiring property and saving for oneself and one's family, combined with obligations to the community and nation. Neither time nor property should be squandered, and sharing with others is often thought to undermine the initiative of the recipients.*

The maladjustment of reservation Indians to white society is enhanced by their continued resentment of injustices, past and present, and nostalgia for the days when they were proud hunters. The older men, particularly, who have the greatest influence on tribal decisions, hang on to as much of the customs and language as they can, spurn any moves towards acculturation and seem deliberately uncooperative except with the rare white man who has won their trust. The younger adults, both Indian and Eskimo, are more Canadianised, have generally had elementary education and speak enough English for trading and employment purposes. They even encourage their children to get a full education, in preparation for a wage-earning job, though they do little to maintain attendance and often take the boys away on hunting expeditions. However this naturally varies from school to school, and parental co-operation was generally good in all those that we visited.

Zentner (1963a) has conducted extensive questionnaire inquiries among Indians and whites in Grades IX to XII in both Oregon and Alberta, and claims that the two races of adolescents are nowadays very much alike in their educational and vocational aspirations and values. Though the Indians do not identify completely with whites,

* Zentner (1964) has described in much more detail the contrast between what he calls the Pre-Neolithic, the Feudal-Agrarian, and Post-Industrial cultures.

and show much pride in their race, many of them believe that Treaty rights should be abolished in order to encourage fuller integration and economic selfsufficiency. Similarly Worsley (cf. Knill and Davis, 1963) obtained essays from senior Meti students in Northern Saskatchewan on: "What I want to be when I am grown up"; and when these were analysed by Knill, they revealed that a majority aspired to professional, commercial or skilled occupations, as did whites, though very few of their choices were likely to be realised. But these writers do not sufficiently recognise that their informants represent the most able 5-10% of Indians. It is unlikely that a survey of the whole range of the age group would show anything like the same enterprise and desire for assimilation into white society. Nevertheless the forthcomingness of the most educated minority is a hopeful sign.

4. UPBRINGING AND SCHOOLING

Both Indian and Eskimo cultures are highly permissive towards, and fond of, young children, despite the occurrence in occasional tribes of such practices as binding to boards (cf. Erickson). They tend to be weaned late and greatly indulged; corporal punishment is never used and there are no angry reactions to misbehaviour, though gentle restraints are imposed on aggression and, later, shaming is used for control. From quite early the children are guided towards responsibilities and adult roles, and there is clear sex differentiation. Thus boys are encouraged to play at hunting and fighting (or riding in ranching communities), and by 10 to 12 are accompanying adult males and achieving their first kills. Generosity and sharing within the group are still prominent. The Eskimo particularly realises his extreme dependence on others for help in adversity. At the same time, family cohesion seems to be more fluid among the Eskimo. Illegitimacy and irregular unions are condoned; children are adopted freely (even when their fathers are white) and sometimes interchanged. Thus, although there is always affection and support, there is a curious lack of personal involvement of the parents in the particular child (cf. Willmott, 1961; Clairmont, 1963).

Though day and boarding schools have long been established on Indian reservations, education in the outlying areas was extremely patchy till recently, depending mainly on the efforts of missionaries. But in 1945-47, the provincial and federal governments took over responsibility for education in all except the most inaccessible settlements (Department of Citizenship and Immigration, 1962). In the

Northwest, for example, there is a school for 900 Eskimos, Indians and whites at Inuvik, and a large proportion of Eskimos are brought in, if need be by airlift from up to 1,000 miles away, and boarded in hostels from September to June. Interestingly, this does not seem to produce much emotional disturbance (Vallee, 1962), perhaps because of the looseness of family attachments already referred to. Whether it is beneficial to abstract them from their natural habitat and interfere with the acquisition of traditional skills is more debatable. For the syllabuses and text-books are the same as those of the provincial educational systems, with little concession to local needs and interests; and practically all teachers are white.

When children enter at 6 to 7 they are considered to make good initial progress, though many have to go into beginners' classes to learn English before starting Grade I work. Some do not start till a later age and they show more learning difficulties. However, in all types of school there is much retardation; the average 10½-year-old is more likely to be in Grade III than Grade V (cf. Knill and Davis, 1963). The majority never achieve beyond Grades V-VI (say, English top junior) standard, though a few proceed to Grade IX-XII work, in secondary or technical boarding schools, and a tiny percentage even achieve university, all without cost to their families. Though motivation is excellent in the early years, it is commonly observed, especially among Indians, that by 12 or so they fall off in keenness and tend to become introverted and suspicious. A plausible explanation is that, with adolescence, they come to realise how little the world holds for them, and they react to the clash between tribal and white values with apathy and withdrawal. In recent years observers in many areas have noted a serious growth of delinquency among unemployed school leavers, both Eskimos (Ferguson, 1961; Clairmont, 1963) and Indians (Knill and Davis, 1963; Zentner, 1963b), characterised by a pose of toughness and resort to the three F's—fighting, fornication and fraud. These youths are disillusioned with the traditional way of life, and aspire to the high living standards of whites, but their upbringing has done nothing to build up the internal moral controls of the white. They exemplify Merton and Cohen's theory (cf. Cloward and Ohlin, 1960) that delinquency arises when certain success goals are accepted as desirable by society, but the means to the attainment of these goals are denied to a segment of the population.

Obviously it is hazardous to generalise regarding the environmental background of Eskimo and Indian boys. Rapid changes are

taking place in the economic circumstances and the adaptation of aboriginal peoples to Canadian education and society. But although living off the land is fast disappearing (Vallee, 1962; Jenness, 1964), it might be reasonable to claim that the aspiration to hunt and trap and the traditional values of the aboriginal still play a large part in the upbringing of boys until the adolescent age. True, they are likely to be severely handicapped in the growth of abilities by poverty, lack of cultural stimulus, language difficulties, family instability and lack of purpose; yet they have the advantage of living in an affectionate and permissive atmosphere, and of encouragement to cope actively with their physical environment. Let us examine the concrete details elicited from the several small samples of boys whom we studied and tested.

5. SURVEY OF BOYS' SOCIOECONOMIC CHARACTERISTICS AND INTERESTS

The Samples. All boys were aged between 10:1 and 11:11 (median 11:1) and they represented the complete age groups of the required race, regardless of school grade. Table I shows the numbers in the various subsamples, and though these are small, certain interesting differences emerged. The Inuvik group is subdivided into Inuvik residents and hostel boys who tend to come from less acculturated families, living more from the land than from wage-earning. Tuktoyaktuk is an isolated Eskimo town on the Arctic ocean. Both Indian schools have small hostels, but collect most of their pupils by bus from a few miles around.

The testing was carried out by the writer and his wife. The interviews on home background and interests, together with certain creativity tests, were entrusted to Mr J. Hawkes—a University of Alberta counselling psychologist with considerable experience of Indians, and Miss D. Potter—a Northwest Territories teacher-at-large. A series of additional group tests of intelligence was given to larger numbers in the Inuvik school by Professor R. S. MacArthur (cf. 1962); but these will be reported on separately.

About one-quarter of the Indians and one-eighth of the Eskimos were extremely slow and difficult to test and interview, usually through difficulties of language or general dullness (they were mostly in Grades I or II). But the others were extremely keen and generally forthcoming. The Eskimo boys were particularly jolly and easy-going, but there was little sign of the reputed shyness and suspiciousness among most of the Indians, once they had learnt that the testers

came from the land of the Beatles, and had seen the Queen and the Duke.

Parental Occupations. Seventy per cent of the hostel and half the Tuktoyaktuk boys (but only one Inuvik resident) claimed that their

TABLE I

SOCIAL AND OTHER CHARACTERISTICS OF SAMPLES OF INDIAN AND ESKIMO BOYS

	Indian		Eskimo		
	Morley	Cluny	Tuktoy- aktuk	Inuvik	Hostel
Numbers	18	22	12	13	25
Percent Delayed Gratification in Chocolate Test	50	32	58	69	48
Median Size of Household	7	8½	8	8½	10
Percent Broken or Unusual Homes	50	23	0	8	40
Median Socioeconomic Index	5	5½	4	5½	5
Median Cultural Index	4	5	4	4½	4
Linguistic: percent rated 1-2	61	35	8	38	40
Percent Schooling Delayed till 7+, or Substantial Irregularity	50	45	17	46	72
Mean Planfulness Rating	3.2	3.1	4.1	3.5	3.2
Mean Initiative Rating	2.8	3.0	4.3	3.8	4.0

parents lived off the land, trapping, hunting or fishing. Many of these would be highly skilled, though often classified at the bottom of the socioeconomic scale.* The remaining hostel boys' fathers were chiefly DEW line employees—mechanics, labourers—while the majority of Inuvik fathers were government or school employees, e.g. janitor. A few were employed at an oil company, bakery, etc., but none appeared to be skilled or nonmanual workers. In Tuktoyaktuk and Inuvik at least 20% were unemployed, though sometimes the mothers earned a fair wage as fur garment workers or cooks. Several men obtained occasional labouring jobs, interspersed with trapping, but probably existed mainly on relief. No boys mentioned soapstone carving or other artistic work, though these are sometimes profitable.

The commonest occupation of Morley Indian fathers was log or post cutting. Most owned a few cattle or horses, and a few made a living from this. Some were called carpenters by their sons—probably not highly skilled. Some fathers were janitors or mothers cleaners, and several mothers made ornaments or moccasins. At Cluny

* According to Blishen (1958), 84% of Indians and Eskimos in 1951 fell in the two bottom grades of his 7-point occupational scale, as contrasted with 34% of English-speaking and 60% of French-speaking Canadian whites.

there was a wide range from casual labourer to housebuilder, farm or ranch owner, and two administrators on the reserve, though again there was a good deal of unemployment, especially in winter.

Housing and Possessions. In all groups the commonest type of home was a fair-sized lumber or log cabin, with a large (though poorly furnished) living room, oil or wood heated, and from 1 to 4 bedrooms. One Eskimo, a janitor and part-time broadcaster, had built a house of lower middle class white standards (with government aid); a few families lived in what can best be called shacks, a few in tents. Western Eskimos do not use igloos, though they may cover a tumbledown shack with snow for insulation.

Almost all the Cluny but scarcely any Morley houses had electric lighting; half the Inuvik and hostel boys claimed to have electricity. Despite the poor furnishings almost all Morley Indians had one or more ancient cars, and most Eskimos a boat with outboard motor; and many possessed 'luxury' equipment such as washing machines, record players, tape recorders, which illustrate the tendency to spend extravagantly when in funds, rather than save for a rainy day. Only in Cluny homes (73%) was there television.

Every boy was asked what he would do if the interviewer gave him \$10.00, and the answers are classified below:

	Indian	Eskimo
Clothes	33%	24%
Food	16	10
Give to parents or buy something for them	16	10
Hockey stick, bike, books, gun, visit relatives,		
etc.	10	10
Save	16	28
Sweets, toys, "shows"	8	25

The Indians especially stressed useful equipment, clothing and food, admitting that their families were sometimes short of necessities. The Eskimos were more willing to save, but also more likely to squander on immediate pleasures.

Delayed Gratification. At the first individual session each boy was offered the choice of a small bar of chocolate now or one double the size if he waited a few days till the testing was completed (cf. Mischel, 1958). The results, shown in Table I, should be compared with 54% of Jamaican, 75% of English, 80% of English-speaking Hebridean (but only 50% of Gaelic-speaking) who chose to wait for the larger bar. Doubtless the response depends to some extent on willingness to trust the tester; thus the Cluny Indians and the Gaelic boys were

certainly the most suspicious. However, the generally lower figures from poorly-aculturated groups seem to reflect their tendency to improvidence, to living for the present rather than the future.

Family Size and Makeup: Overcrowding. The interviewer tried to extract the numbers and relationships of persons living at home, though this was often difficult as the numbers ranged up to 14, possibly 20 in one instance. Frequently there were married brothers and sisters, or the boy might be living with grandparents or show no clear affiliation—particularly among the Morley Indians and the Eskimo hostel groups. From Table I it may be seen that size of family was greatest in the latter. Broken or unusual households, including others besides the nuclear family, grandparent or married sib, are shown in the same Table. They total 28% for all groups combined, whereas the corresponding figure for English and Scottish samples was 8%. Overcrowding ranged up to 9 persons in a 2-room cabin, though the average persons per room was close to 2.

Socioeconomic Index. A rough index with a possible range of 0-12 was based on skill of parental occupation, overcrowding, no. of wage-earners, type of house and equipment. This could not be compared directly with the scale used in England, but the English mean would be approximately 10, and less than 10% of the most prosperous Indians and Eskimos would overlap with the poorest English scores. The main value of the index is to show that all five subgroups were fairly closely comparable, though on the whole Cluny and Inuvik were a little better off, and Tuktoyaktuk the poorest.

Cultural Level: Health. Similarly a cultural-stimulus index ranging from 0-8 was based on parental education, school standard reached by older sibs, evidence of parental interest in schooling and amount of reading at home. The English median would be 7 on this scale. Again the Cluny Indians are slightly the best; 16% of the Eskimo hostel boys had lower scores than any member of the other four groups. Almost every boy claimed that his parents wished him to get a good education and expected him to complete a secondary course or better. Few, however, said that their parents asked them about what they did at school, or that they received any help with homework other than from older sibs.

Although most Canadian Indian and Eskimo children are clearly living in much poorer economic and cultural conditions than English or Canadian lower class, it is worth pointing out that these have advanced considerably over the past 20 to 50 years. Sizes of families are increasing, the birthrate being some 3 times that of whites, but

health and educational provisions have also improved. Some families are earning substantial wages, even if few are fully self-supporting.* Many children were shabbily dressed and some inadequately for the climate; but the majority would scarcely be distinguishable from poorer class Canadians by dress or cleanliness alone. It was not possible to collect reliable assessments of health and nutrition. Doubtless there is underfeeding, poor management and choice of diet in many families (e.g. carbohydrates and tinned foods rather than the traditional protein and fat which the climate demands). But defective health or nutrition were certainly less obvious than in the West Indies (Vernon, 1965). The Eskimo hostel group contained the greatest number judged as above average in health, possibly because of the good food and care they had received over an average period of 3 years.

Linguistic. A 1-5 rating was made of the amount of English used in the home, 3 representing half English and half Stoney, Blackfoot or Eskimo. The percentages with little English, given in Table I, show that the Morley group was most handicapped in this respect, Tuktoyaktuk the least. The Indians commonly used their own language on the playground, the Eskimos almost always English. The hostel group had little language difficulty, despite their home background, since older boarders (up to 16 years or more) used English all the time, and the younger ones picked it up quickly.

Irregular or Delayed Schooling. Only rough records of attendance were available, but age of starting school was known, and the percentages starting more than 1 year late (or missing a lot subsequently) are shown in Table I. Only 5% of English pupils show comparable irregularity, and in addition they have the extra year from 5 to 6. Clearly schooling has been most regular at Tuktoyaktuk, most irregular or delayed among the hostel Eskimos.

Planfulness. A rough 1-5 rating for planfulness or purposiveness of the home vs. improvidence and irrationality was based on informal conversation about the house, belongings, parents, food and clothing needs, boy's duties and interests, saving, etc. Again no direct comparison with English norms is possible; but the Indian and Eskimo mean might well be 2 points lower than that of whites. The Tuktoyaktuk community is definitely more stable and better organised than most, but otherwise there is little to choose (cf. Table I).

Boys' Leisure-time Activities. All boys had recognised duties such

* Recent estimates of median income are around \$2,000, including the products of nature, allowances and relief, or say £8 per week in terms of cost of living.

as bringing in water, chopping wood, feeding or rounding up animals, taking out the garbage, baby-sitting, etc. Interests cannot readily be tabulated since very varying numbers of activities were mentioned. All the Eskimos and 68% of the Indians clearly regarded hunting, trapping or fishing with adults as a major interest, though the animals varied: at Morley, deer, elk and fish predominated; Cluny—deer, ducks; Inuvik—muskrats; Tuktoyaktuk—ptarmigan, geese; hostel boys—seals, caribou, ducks, fish. Hunting or fishing on their own was also frequently mentioned by Eskimo boys, especially the hostel subgroup. Among Indians, horseback riding was mentioned by 45%, but ice-hockey, skating and swimming were also much more popular than with Eskimos. Ball games were referred to by one-sixth of both groups, but miscellaneous "playing with friends" occurred much less frequently than in England.

Reading was claimed by 34% of Eskimos and 55% of Indians, but it was clear that few boys or families had more than, or even as many as, half-a-dozen books and that most reading was confined to comics or an occasional magazine. Nevertheless there were one or two in most groups whose reading is comparable with that of an English boy who has passed the 11+. Under the constructional heading, 80% of Eskimos claimed to make boats, bows and arrows, guns, airplanes, etc. (no subgroup differences), and 8% did carving; whereas 45% of Indians mentioned more large scale carpentry such as bird-houses and corrals. Model kits could probably not be afforded by either. Very few indoor games were mentioned, though observation during home visits revealed that there were various traditional sleight-of-hand and gambling games, and often some toys.

Boys' Occupational Aspirations. Boys were asked what they thought they would be when grown up, rather than what they would like to be. On the whole the answers, classified below, are pretty

	<i>Indian</i>	<i>Eskimo</i>
Professional (doctor, priest), office, store	5%	12%
Mechanic; bus, lorry or boat driver	6½	4
Builder or carpenter	25	8
DEW line or Government work	—	12
Ranching, raising cattle	12½	—
Farming	12½	—
Log or post cutting	17½	2
Trapping, hunting	—	38
Police, cowboy, army, pilot	11	24
Don't know	10	0

realistic (more so than their educational aspirations), the majority choosing the same as their fathers or else jobs which they had actually observed among adults in their communities (cf. French, 1962). The penultimate category might be regarded as fantasy jobs, but the rather high proportion of Eskimos in this category is due mainly to the popularity of "police" in Tuktoyaktuk where, indeed, a few adults are employed by the RCMP. Very few boys, it will be seen, envisage skilled trades. Over three-quarters of all choices represent outdoor jobs. Among the Eskimos 52% of hostel boys and 24% of town ones think they will be trappers or hunters. Ferguson (1961), working in Tuktoyaktuk, points out that although life on the land is nowadays likely to be less profitable than wage-earning, it still has the highest prestige. Next in order of appreciation are occupations such as boat-building, which are carried out by Eskimos themselves, independently of white supervision.

Initiative. No rating was given by the interviewer for male vs. female influence or dominance, as in England, since masculine identification was obviously predominant in every case. However, an attempt was made to assess initiative on the same 1-5 scale as with English and Hebridean boys, on the basis of active, resourceful interests and vocational aims, and self-reliance. The mean rating in England was 3.0, and it seems fair to credit the Indians with similar, the Eskimos with distinctly higher, scores (cf. Table I), though obviously any comparison must be highly subjective. It is deplorable that, as these boys get older, nothing could be better calculated to depress such initiative than life on an Indian reservation, or in a white settlement in the North.

(The Bibliography will be given, along with the test findings, in Part II)

LINGUISTICS AND GRAMMAR: AN INTRODUCTION TO A BIBLIOGRAPHY

by H. W. YOUNG

*Head of the English Department, Rainey Endowed School, Magherafelt,
Co. Londonderry*

I. INTRODUCTION

ALTHOUGH the term "linguistics" has now attained some general currency there is still, it would seem, widespread ignorance about the scope, aims and methods of this new field of study. It is even more disappointing, however, to encounter on the part of many teachers and literary critics a settled prejudice far in excess of that legitimate measure of scepticism which is, one must admit, desirable in the confrontation of a rapidly growing corpus of studies which claim, in their allegedly new descriptions of the workings of language, to be scientific. Besides the patent suspicion that linguistics is a pseudo-science that attempts to substitute one unsatisfactory nomenclature for another without providing any really fresh illumination, there is also the feeling that linguistics and literature are antipathetic, that a deep antagonism exists between the poet's or novelist's creative use of language on the one hand and the linguist's clinical dissection of it on the other.

Do not all charms fly
At the mere touch of cold philosophy?

Mr Anthony Burgess, for instance, has recently been stung by criticism into protesting in *The Times Literary Supplement* (22nd April 1965) that readers of fiction who will "lap up references to bleeder-screws, distributor arms and all the technical magic of Shuteland", will not tolerate the technical linguistic terminology which he has employed in some of his own novels. In an article significantly entitled "Novels are Made of Words" he writes, "Literature, I am told (though not by those feeders on the body of Shaw), has nothing to do with linguistics. This is the general view, and it is unfortunate for the novelist who is interested (and all novelists should be) in language."

It is equally obvious, I think, that all teachers should be interested in language. In fact, the present writer wishes at the outset to assert two strongly-held convictions: first, that teachers of English must begin seriously to take cognisance of what scientific linguistic research has elicited about the structure of the language that they use and which they have the privilege—and responsibility—of teaching; and, secondly, that some of the teaching profession must, for surely only practising teachers can, get down to the essential tasks of sifting and re-formulating the new linguistic knowledge in terms that will be practicable in the classroom, particularly with regard to grammar. This paper will therefore attempt to indicate the scope of linguistics, enumerating briefly some of the factors that have combined to produce the immense contemporary interest in language studies. Its essential object, however, is to provide a bibliography of recent work which will be at the same time sufficiently comprehensive to interest students of linguistics and yet manageable enough to encourage the uninitiated to embark on a course of basic and stimulating reading. It is hoped, moreover, that the article will, by its very arrangement, prove helpful also in its indication of where various linguistic topics may most profitably be studied.

2. THE SCOPE AND DEVELOPMENT OF LINGUISTICS

Linguistics is the science that purports, in the succinct phrase of Carroll (1953), to provide us with "a systematic theory about language in general and languages in particular". Modern linguistic studies, therefore, deal primarily with three major facets of any language; with its substance (phonic or graphic), its form (that is, its internal system of relationships) and its context.

In view of the long standing dispute about its status in the teaching of English, this paper will concentrate chiefly on grammar for, apart from the fact that this is most probably the aspect of language with which teachers consider themselves to be principally concerned, much recent linguistic research has been aimed at the establishment of new grammatical categories which will more accurately mirror the way in which our signalling system operates than do the traditional descriptions. It is essential, however, to bear in mind that the new grammar insists on the priority of speech patterns, with the result that phonology, the examination of sound patterns, is an integral part of linguistics, involving, among others, the concepts of stress, pitch and juncture. Since many linguists distinguish four levels of stress, four levels of pitch and four levels of juncture, it will be

appreciated, even without definition and illustration, that the interplay between the various patterns of utterances can indeed be very complicated, and that the analysis of a sentence as, say, an "intonation contour" may provide us with a vital part of its meaning. The topics of stress, pitch and juncture are usually, in the most recent books, linked with the grammatical material through the discussion of punctuation as, for example, in the opening chapters of a classic study by Hill (1958), and in the closing chapters of a lucid exposition by Roberts (1956). Considering the differences between our own teaching methods and those of the United States it is interesting to note that both of these fine American books have been highly praised by British linguists.

Also below the grammatical level, two further concepts, those of phoneme and morpheme, have retained in linguistic discussions the vitality which was claimed for them by the American scholars who first gave them currency. Professor Roberts (1956), all of whose books are models of logical presentation and clarity of style, neatly introduces the first of these. "A phoneme", he writes, "is not exactly a single sound. It is more a collection of similar sounds which in spite of their slight differences, sound the same to a native speaker of the language. If the native speaker hears them as the same, they are the same for him, and they make up one phoneme." It may be surprising to learn, for example, that the sounds represented by the letter p in "papa", "spin" and "top" are actually four quite different sounds; in some languages they might be significantly different. But since the native speaker of English hears them as the same sound we say that they are varieties, or, to use the recognised term, "allophones" of the phoneme /p/. Phonemes have no meanings of their own, but they enable words or other elements to carry meaning by making them phonetically distinguishable from one another.

Aristotle, as Ullmann (1962) has pointed out, defined words as the smallest significant units of speech. Modern linguistics, however, has discovered significant semantic units below the word level with the result that the term "morpheme" was introduced to designate the irreducibly significant segments of language. Defining morphemes as "the smallest individually significant elements in the utterances of a language", Professor C. F. Hockett (1958) demonstrates that the sentence: "John treats his older sisters very nicely" contains thirteen morphemes: (1) John; (2) treat; (3) -s; (4) hi-; (5) -s; (6) old; (7) -er; (8) sister; (9) -s; (10) very; (11) nice; (12) -ly; (13) the intonation of the sentence.

Having its ultimate inspiration in Leonard Bloomfield's brilliant and seminal book *Language*, the analysis of language based on phoneme-morpheme theory ("phonemics" and "morphemics") became strikingly influential in the 1950s chiefly through the writings of American scholars whose work at this time was generally termed "structural linguistics". Professor Hill's book, mentioned above, bears the sub-title: "From sound to sentence in English", thus providing a neat summary of the procedure of this group of writers who frequently offer us comprehensive and subtle discussions of the phonology and morpheme-structure of English, working all the time from smaller to larger units. Besides Hill's volume, it is essential to mention several others, including those by Hockett (1958), Harris (1952) and by Trager and Smith (1951).

Almost contemporaneously with the last item, there appeared an illuminating study by Fries (1952). Taken together these two studies have supplied the impetus for many of the subsequent developments in linguistics. Fries, however, being convinced that "the conventional formal grammar is, like the Ptolemaic astronomy, falsely oriented", was anxious to introduce a vitally new approach to grammar since the traditional descriptions, in his view, "cannot be expected to provide any satisfactory insight into the mechanisms of our language". This scholar's interest in grammar had dated from at least 1927 when, in a most illuminating article, based on a study of fifty-two comprehensive grammars published between 1586 and 1825, he demonstrated that the major presuppositions and errors of these works survived almost in their entirety in Lindley Murray's widely influential *English Grammar* of 1795, over two hundred editions of which were published during the nineteenth century. In fact, therefore, many, perhaps most, grammars of the twentieth century also continue to perpetuate the linguistically inadequate notions of the earlier compilations.

3. TRADITIONAL GRAMMAR: UNDERLYING ASSUMPTIONS

Even a brief survey, such as is offered by Professor Randolph Quirk (1959), of the long dispute about the teaching of grammar reveals clearly that the welter of angry voices, repudiating or advocating grammar in class, is symptomatic of a deep uneasiness, the advocates being distressed at the possible total abandonment of grammar and the enemies frustrated by the inadequacy and anomalies of the traditional descriptions. It is appropriate, therefore, to consider at this point the basically misleading nature of these descriptions and to refer to those modern linguistic studies which offer

to correct them or to supply new, and more scientific, definitions in their place.

Primarily, the divergence between the traditional and the new grammar is this: the descriptions accepted until recently rest on the *assumption* that all words in English should be classifiable into eight or seven or nine categories or parts of speech. If that is so then it should always be possible to take any random sentence and classify all the words. "But", says Professor Roberts (1956) who has experimented widely in the application of linguistics to teaching-programmes, "this is something I have never been able to do and I have given most of my life to the study of grammar." It is a common experience that even with vigorous manipulation and with frequent resort to ellipsis, a favourite but linguistically unsound device, there remain items which refuse to fit any of the ready-made pigeon-holes. Modern linguistics on the other hand seeks to be scientific by avoiding all *a priori* schematisation and by employing, in the words of Professor Strevens (1963), "only those categories which it is necessary to invoke because they reflect the way the language really operates".

In the exploration of their subject-matter all branches of academic study, particularly the physical sciences, make wide use of models and analogies which, having helped the researcher first to establish and then to probe his theories, are abandoned when it becomes evident that a newer model is a more faithful approximation to the available data. In language descriptions, as the previous paragraph implies, the model that is commonly employed, by most people unconsciously, is that of a set of pigeon-holes. Very recently, Miss Barbara Strang (1962) has issued a heavily-underlined warning that this is, linguistically, a particularly misleading metaphor. The stage has now been reached, she believes, when this outmoded concept of language, with each pigeon-hole clearly and distinctly occupied with something quite separate from what is in the other holes, must be resigned. Instead, linguistic items can now best be differentiated by thinking of them "as fitting at different points on a continuous graded scale with overlap, borderline cases and no sharp dividing lines".

It is also, strangely enough, still essential to stress that traditional English grammar was largely the application of the rules of Latin syntax to our own language, a fundamentally unsound notion since English is a different kind of language. Unfortunately, this notion of Latin as an archetypal exemplar of all languages has existed for a long

time, and, it seems, still exists. James Buchanan, for instance, introducing his *English Grammar* in 1767, complains about the incorrectness of Addison, Swift and Pope. If it be urged in their favour, he continues, that at this time these writers had almost no guidance, English being "but very little subjected to grammar", a question readily occurs. "Had they not the rules of Latin Syntax to guide them?" But only yesterday, so to speak, Mr G. S. Frazer, writing in *The Times Literary Supplement* (14th January 1965) about the mediocre quality of students' prose style, commented, "nor has elementary Latin syntax helped them much". To this Professor W. S. Allen, shortly to be mentioned again, retorted in the following issue that he didn't see why Mr Frazer, dealing with English, should expect Latin syntax, elementary or otherwise, to help his students unless he believed that "there is a universal syntax of which Latin is the supreme manifestation". The imposition of the Latin framework upon English has resulted in many anomalies in the description of our own language. A major emphasis in modern linguistics is that categories which adequately reflect the operations of one language may be, so to speak, "askew", if transferred to another. There is never, even for those which have some application in several languages, a point-for-point correspondence between linguistic categories.

With the remarks about Latin still in mind, a further point may now be made. A Roman schoolboy learned that a noun was the class of word that was subject to inflection for number and case, and the observation that a noun was generally a name was added incidentally. But from the Renaissance until now, as Halliday, McIntosh and Stevens (1964) have made clear, a noun has been described as the name of a person, place or thing, this being the defining criterion and the formal features being relegated to incidental status. In other words, the conceptual category, the meaning, replaced the formal one so that in our traditional grammar words are classified on the basis of meaning. It is, however, a tenet of modern linguistic science that words are more satisfactorily classified by the way they operate in patterns and according to the "frames" into which they fit. Once again, formal criteria are coming to the fore, the result being that structure, pattern, helps to determine meaning, and not vice-versa. In fact, the authors of some of the earlier studies in "structural linguistics" refused to deal with meaning at all, concentrating exclusively on formal relationships. Recent British scholarship, however, regards this standpoint as mistaken, and, while still allowing to formal relationships a more significant rôle than was formerly accorded to

them, holds that meaning should always be considered conjointly with them.

In the light of the preceding discussion it should now be obvious that when Professor W. S. Allen chose for his inaugural lecture at Cambridge the title "On the Linguistic Study of Languages", he was not falling into tautology. Indeed, Professor Quirk (1959) attributes the present malaise in the teaching of English language precisely to a non-linguistic approach. "It is not so much", he writes, "that the Latin terms do not suit English as that the non-linguistic frame of reference does not suit language." In short, generations of pupils have been brought up to describe language in terms that are logical rather than linguistic, conceptual rather than formal, that is in definitions that do not accurately account for the various systematic discriminations that are operative in English. By contrast, the linguistic approach is empirical, seeking to establish what distinctions are actually functioning in language, to retain only the categories that are valid, and to avoid the procrustean methods of the past.

It was in an effort to clarify the numerous anomalies of the traditional grammar that Paul Roberts in 1954 published one of the most lucid and illuminating treatments of our syntax that exists. An even more recent disquisition is to be found in an important work by Halliday, McIntosh and Strevens (1964) where the authors, using four modern reputable grammars to illustrate the kinds of confusion that all teachers feel, classify the errors under five main headings and two subsidiary ones: unclear categories, heterogeneous criteria, fictions, conceptual formulations, value judgments; plus, on a secondary level, inaccurate phonetics and confusion of media.

In the face of such prevailing linguistic uncertainties as they enumerate, it is natural enough either that grammar should cease to be taught or that it should be taught in a way that is linguistically unsound, in the manner, in fact, with which we are all too familiar and which is neatly summarised for us by Miss Nancy Martin (1965), a lecturer in the teaching of English at the London Institute of Education. "The existing mode of teaching grammar", she writes, "is to move from unchallenged definition to illustration or precept. But the method should be descriptive rather than prescriptive, and should follow the general pattern of any other scientific study, viz. observation of actual data should be made, and tentative conclusions drawn which would then be modified by subsequent observation."

It is obvious, surely, that teachers need to become acquainted with a scientifically-based grammar of modern English, such as has

recently been produced in outline by Mr W. H. Mitten (1962), and also that our teaching methods must be radically revised to accord with the findings of contemporary linguistics.

4. THE NEW GRAMMAR

(a) *Charles Fries and Noam Chomsky*

Inevitably, as one might expect, the linguistic research of the past decade has induced radically new attitudes to grammar as the deficiencies of the conventional descriptions became more clearly revealed. To anticipate the accusation that the new nomenclature alters nothing but the terminology, that it is merely another instance of "plus ça change, plus c'est la même chose", the present writer contends that anyone who is prepared to consider the new grammatical systems judiciously will realise that, whatever objections may be urged against them, they are at least vitally fresh orientations, attempts to formulate the actual functioning of language as distinct from the dogmas of the older grammarians about how it ought to function. It is therefore proposed to mention now the approaches to grammar associated chiefly, though not exclusively, with the names of Fries (1952), Chomsky (1957) and Halliday (1961) in the hope that the reader will be encouraged to read these for himself.

In his book of 1952, previously mentioned, Fries wrote, "The grammar of a language consists of the devices that signal structural meaning", a statement that epitomises his treatment. Forsaking the traditional parts of speech which were, it has been pointed out, classified chiefly on the basis of meaning, and, to a lesser extent, of form, he set up his word-classes on the basis of distribution, that is by grouping together those words that behave similarly in a given matrix. Using the notion of a sentence as a "test frame", he pointed out that, for example, in the sentence: "The concert was good", many other words such as "food", "coffee", "company", could be substituted for "concert" without altering the structure of the sentence. All words which could thus be substituted were therefore members of the same word-class. It is, in fact, now an important distinguishing feature of human language that every occurrence of it is a substitution frame. Thus Hill (1958) declares, "Any sentence is a series of entities, for each of which a whole group of other entities can be substituted without changing the frame." This characteristic of infinite substitutability helps us to establish what Barbara Strang (1962) terms "function spots", that is structurally meaningful places in the sen-

tence, and it also enables us to understand sentences that we have not previously heard. According to the behaviour of words in certain carefully chosen environments Fries established four very large form-classes which he designated Class I, Class II, Class III and Class IV. Since these classes approximate roughly with the traditional terms, nouns, verbs, adjectives and adverbs respectively, most linguists now retain the familiar descriptions with the reminder that we must think of them in a different way and that they do not necessarily always mean or include the items we have been brought up to understand by them.

Besides the form-classes which are infinite in size, and therefore known as open classes, Fries also distinguished fifteen groups of structure words which he indicated by letters of the alphabet. These groups, being severely limited in membership, are the closed classes whose purpose is to provide the structural signals of our sentences, to bind the form-classes together in various ways by building a framework in which the form-classes are set, thus enabling us to express complicated meanings. The function words, which are usually lexically empty, pattern in ways that are quite different from the behaviour of the form-classes.

Another major concern of modern linguistics is to elucidate systematically the way in which words hang together in clusters, a fascinating topic that emphasises the complexity, subtlety and beauty of English. Linguists distinguish word-groups as endocentric and exocentric, or as headed and non-headed groups respectively. Whenever the situation exists where a single word within a group can be substituted for the group as a whole without any formal dislocation of the grammatical structure, then that word is the headword, and the group as a whole is a headed group. The headword, commonly a noun or a verb, is, so to speak, the nucleus of the cluster, the energy that binds the group together, while the other members are present to modify the headword, being attracted towards it, as to a pole, in a complex variety of ways. In a non-headed or exocentric group on the other hand, no single word within the group can substitute for the entire group and make sense, nor can the entire group substitute within the same surrounding context for any of its constituent parts. Such groups, that is, have no centre towards which the other members are attracted, and consequently they operate in a manner quite different from that of the endocentric groups. Professor Quirk's distinctively illuminating and authoritative book (1962) contains a most useful chapter on "The Grouping of Words into Structures"

which could profitably be read before one embarks on the immensely detailed treatment of the same topic by Hill (1958).

In discussions about the poor quality of the writing in G.C.E. examination scripts, it has lately been pointed out, by Mr W. H. Mittens (1959) among others, that the faults are largely structural, that the majority of the candidates have no facility in varying their sentence structure because of their ignorance of the syntactic resources of English, discussion of which is now regarded as an essential part of the new grammar. Large-scale consideration of the sentence structure of English has confirmed the thesis that all the possible utterances of our language are really an infinite variety of expansions or transformations of a very few basic and irreducible sentence structures. In the exemplification of the ten fundamental sentence patterns, the words are sometimes accompanied by formulae whose purpose is, so to speak, to lay bare the anatomy of our language, to penetrate to and display the skeletal structure or framework beneath the living flesh of words. In this way it is shown, surprisingly at first perhaps, that grammar can exist outside what is ordinarily called meaning.

The delineation of the form-classes and the structure-groups according to Fries, discussion of word groupings, endocentric and exocentric, and the illustration of the basic sentence patterns and their expansions are all skilfully embodied in *Patterns in English*, which, it should be stressed, Paul Roberts designed not as a work of scholarship but as a text-book for (American) schools. Nevertheless, the lucidity of the presentation and exposition guarantee this book as a valuable introduction to the linguistic topics under review.

The discussion of the variation and expansion of the basic sentence patterns has lately been raised to a high degree of subtlety in the work of Noam Chomsky of the Massachusetts Institute of Technology, who is regarded as perhaps the outstandingly creative linguist of our time. His book (1957) which deals specifically with English, develops at a high theoretical level the notion that all the complex utterances of English, the passive construction for example, are generated from the basic sentence patterns through application of one or more operations known as transformations. As a very simple example it may be mentioned that sentences of the form: "A man is here" belong to pattern eight. Now some pattern eight sentences, though not all, can be changed into a pattern beginning with the word "there", so that the correct transformation generates the sentence: "There is a man here", which is no longer a basic, but a derived,

sentence pattern. It should be added that sentences of the latter type can be derived only from sentences in the pattern eight category.

The transformational grammar is a powerful instrument in the sense that it sets out to account in principle for all sentences that are regarded as grammatical in the language and to exclude all others. As Chomsky himself writes, towards the end of his book, "So far we have considered the linguist's task to be that of producing a device (called a grammar) for generating all and only the sentences of a language, which we have assumed were somehow given in advance." It is interesting to note that the Chomsky approach takes over but reverses the "sound to sentence" procedure of "structural linguistics", moving instead from sentence to sound though a tripartite series of rules—those of phrase structure, transformational structure and morphophonemics—which must be applied in a strict order. It must be insisted that the generative—transformational system is much too complex to be summarised briefly or simply. A very clear outline of it, however, appears in chapter twelve of a fine study by Gleason (1961). And while Chomsky's own exposition is, of course, indispensable, the transformational section of the system is brilliantly incorporated in another teaching book by Paul Roberts (1962) which is, yet again, a masterpiece of lucidity.

(b) *M. A. K. Halliday*

There can be no doubt of the general vitality and pervasiveness of American linguistic scholarship. And particularly with regard to grammar the influence of Fries and Chomsky has been so widespread, even in Britain, that one could too easily assume that at present only their grammatical models bear the sanction of linguistics. In fact, however, during the last decade the research of such British scholars as Professors Angus McIntosh and M. A. K. Halliday has resulted in the introduction of several linguistic hypotheses whose validity by now seems to be fairly well established. The existence of such new concepts may be attributed chiefly to the steadily growing conviction over recent years that detailed linguistic description could proceed more confidently and develop greater sensitivity if it were possible to set up groups of theoretical categories, characteristic of language as a whole, under which the empirically verifiable categories of particular languages were subsumed. It was felt that, as in science generally, the more comprehensive the theory, the more explicit and coherent would be the description of particular examples of it. Lately, as we know, the categories of English grammar have been

rigorously re-appraised to avoid unsatisfactory *a priori* definitions. But since even such categories, though clearly valid for English, were obviously not universally applicable, linguists believed that they might be asserted with greater assurance if they could be shown to be instances of concepts of much wider generality inherent in the nature of language itself.

A vitally important discussion of the relationship between the descriptive and the theoretical categories is presented in M. A. K. Halliday's widely influential paper (1961), where he postulates four theoretical categories: unit, structure, class, and system, these being intended to account for the basic grammatical patterns of all languages.

Language is not just something that exists. It is an activity in which, so to speak, items follow one another as in a chain, and in which at various places along the chain the speaker is confronted with the possibility of choice of one item rather than another. It was through contemplation of the chain and choice aspects of language that Halliday was induced to set up his theoretical categories. In brief, the concept of unit accounts for meaningful stretches of language of varying extent, of which, at a descriptive level, sentence or clause are instances. Structure is the category which subsumes the nature of such units, subject and complement, for example, being names for certain elements in the structures. Both the categories of unit and structure are derived from the chain characteristic of language while, on the other hand, those of class and system are derived from the choice aspect since the speaker must at a certain point select an appropriate item, say a noun or a verb, from a word-class, and he must, moreover, decide suitably every so often between such items as singular and plural which are mutually exclusive alternatives in a closed system. Incidentally, one may advert here to Carroll's definition, quoted earlier, of linguistics as "a systematic theory of language". It should be obvious by now that theory in this context does not mean a supposition or an impression but, in the words of Professor Strevens (1963) once more, "a group of abstractions derived from the observation of facts and embodying all those hypotheses about the nature of language that have been found valid".

In addition to his theoretical categories, Halliday posited three scales of abstraction, those of rank, delicacy and exponence, whose purpose was to link the categories to each other and to the language data. His account of the functioning of language is therefore sometimes known as a "category-scale" grammar. To consider just one of these scales, that of rank is the hierarchical ordering of the units em-

ployed in the description of a particular language, the following being recognised in English: sentence, clause, group, word, and morpheme. It is, of course, a well-known feature of language that each unit operates in the structure of the unit next above it. But it is less clearly recognised that quite often a unit is, so to speak, downgraded, that is shifted down in rank to operate in the structure of a unit of the same rank as, or of lower rank than, itself. Thus the sentence: "The room where I work is bright" consists *in its structure* of only one clause. The clause: "where I work" is shifted down to operate in the structure of the group: "The room where I work". Halliday employs the term rank-shift for this kind of phenomenon.

It should be clearly understood that this brief introduction of Halliday's terminology does not represent an attempt to summarise his system adequately; indeed that would be impertinent. It is designed only to direct the reader to an illuminating source of insight into the subtle operations of language.

The increasing recognition of the wide-ranging significance of Halliday's views may be emphasised, finally, by a citation from Enkvist, Spencer and Gregory (1964): "The scale of rank and the concept of rank-shift make clear and help to describe accurately the infrastructuring nature of language: how a number of units act as one in the structure of another unit; how structure in language is not a mere linear progression, but has depth also. They help to isolate and illuminate where the structural complexity in a text lies." Mr Burgess could very well recommend this excellent book to those who fail to appreciate the interdependence of linguistics and literature.

5. GRAMMAR AND LINGUISTIC PHILOSOPHY

It seems relevant to consider, in the final part of this essay, a few of the many interesting facets in the history of linguistics. There is, first of all, an ancient and paradoxical relationship between philosophy and language studies. The medieval grammarians, for example, sought to explain the grammatical categories as reflections within language of certain logical relations. Ironically, these logical relations had been derived—by Aristotle originally—from the very linguistic patterns which in medieval and later times they were being used to explain. Of more immediate interest, however, is the fact that in the early 1930s there occurred a revolution in English philosophy whereby, crudely speaking, metaphysical speculation was replaced by rigorous linguistic analysis. "On this view", as John Wilson (1963) succinctly puts it, "the philosopher has no longer any

direct connexion with ways of life, motives, behaviour or values at all. He is an analyst of language, concerned with the verification and meaning of statements and with the logical use of words." Since the new movement focused attention upon the problem of language itself, it was natural enough that the discussions in which linguistic philosophers engaged should involve, at times, the consideration of grammatical forms. One may instance the discussion where Professor A. J. Ayer (1962) points out several examples of how earlier philosophers had been betrayed into insoluble metaphysical questions because they were, as he says, "misled by superficial grammatical features of the language". In the same discussion the phrases "duped by grammar" and "deceived by grammar" also occur. Moreover, it is largely thanks to linguistic philosophy that we have recently substituted a dynamic for a static model of the relationship of words to things, no longer thinking of words as pictures but rather as tools that are adapted to a wide variety of ends. Wittgenstein's statement (1953) about words is well known: "For a large class of cases the meaning of a word is its use in the language." There can be no doubt that since the later work of Wittgenstein especially, modern philosophers and linguists have begun to find each other's writings mutually stimulating with the result that from the 1950s their respective disciplines have received an added impetus. Significantly too, semantics, which has existed as an independent discipline since about 1825, took on a new lease of life in 1931 when Gustaf Stern published his famous study of changes of meaning in English.

6. LINGUISTICS TO-DAY

In fact, it seems as if all the disciplines concerned with language began to gather momentum in the 1930s. Having referred to modern philosophy and semantics, we may now recall that Leonard Bloomfield's *Language* appeared in 1933, this volume containing the kernel of many later developments in linguistics. But it was in the 1950s again that the really important research in linguistics began and that much truly original work was published, for instance the books by Fries, Trager and Smith to which attention has already been drawn. One might mention also the establishment of the Communication Research Centre at University College London in 1953.

Since then the rapidly increasing numbers of scholarly works on linguistic principles have underlined the central importance of English in the modern world. And in Britain the obligation to conduct the research, more necessary now than ever, into the many language

problems that still demand clarification has been recognised in the foundation of two new chairs, that of English Language at University College London in 1961, and that of Contemporary English at Leeds in 1963. The first incumbents, Professors Randolph Quirk (1961) and Peter Strevens (1963) respectively, stress among many other items in their inaugural lectures "that the descriptions of English language taught in most schools leave a great deal to be desired" and that consequently there is "an urgent need to augment and improve the teaching of English language at all levels in Great Britain".

7. CONCLUSION

Finally, it is hoped that the appended bibliography together with the introductory comments of this article may prove useful in assisting the teacher-librarian to make a selection of books, either for personal reading or for his library. Naturally, he will not wish to be directed in his choice. The present writer feels, however, that two books especially should be available to all teachers of English: Randolph Quirk's *The Use of English* (1962), and a volume, hitherto unmentioned, entitled *Linguistic Change in Present Day English* by C. L. Barber (1964). This study consists of lectures delivered to students of English in Poland to whom the author addressed this exhortation: "Your own speech in the mother tongue and the speech of the people around you, is always the right place to begin language study. Once again, try to approach your own language with a fresh eye, uncorrupted by the grammar you were taught at school; for, unless your country is more fortunate than most, the grammar you were taught at school probably included a good deal of nonsense."

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A COMPARISON OF THE ACADEMIC QUALIFICATIONS OF TEACHERS OF MATHEMATICS IN SINGLE-SEX AND CO-EDUCATIONAL GRAMMAR SCHOOLS RESPECTIVELY IN THREE CONTRASTED AREAS

by R. R. DALE

Senior Lecturer in Education, University College of Swansea

I. INTRODUCTORY

THE survey given here is not based on a national sample but on the relevant population of three contrasted regions of which two were included because the data was needed to connect up with other research, and the third was added partly as a contrast to the others. The work is an attempt to provide additional evidence bearing on the intriguing problem of the discrepancy between the attainment of girls' schools in mathematics, and their attainment in most other subjects, when compared with the attainment of girls in mixed schools, as measured by the first external examination. Researches have shown that girls in mixed schools, maybe because they took the examination some three months younger and were of rather lower social class,* did slightly less well than girls in girls' schools, with mathematics a notable exception. In passing it should be mentioned that boys in mixed schools did better than boys in boys' schools in most if not all subjects, including mathematics, in spite of a social class handicap.

Why should girls in mixed schools tend to reach a superior standard in mathematics? Is it because they acquire from the boys in the class a more effective approach, or a deeper insight? Is it because they acquire a better attitude to the subject from the boys? Might it be possible that a sex difference exists in the ability to teach mathematics—men tending to be superior to women (and women superior

* A full discussion of this point is given in *Educational Research*, June 1962, pp. 207-17.

to men in the teaching of literature)? Or might the discrepancy be due, in part or wholly, to a marked difference in the quality of the teachers which the two types of school are able to recruit? The writer is making inquiries into most of these questions, but this article is confined to the last of them.

ACADEMIC ATTAINMENT AND TEACHING ABILITY

The task, then, was to secure some measurement of the ability of the teachers of mathematics in the two types of school. A possible method would have been to have sent an assessor to see each teacher take a lesson, but this would have been extremely expensive and the necessary resources were not available. In addition it could be argued that such an artificial situation might set up a systematic bias in that the two sexes of teachers might respond differently, whether they were fore-warned or not. A more practicable method, though admittedly not perfect, was to discover and collate the academic qualifications of the relevant teachers. We know that a teacher with a high degree is not necessarily a good teacher, and a teacher with a poor degree, or no degree, may be a very good teacher indeed. On the other hand, many teachers with a poor degree might be unable to cope efficiently with the intricacies of Advanced Level mathematics, and this weakness might conceivably operate at the Ordinary Level, though probably only with a small proportion of teachers and only in a few portions of the syllabus. It could be argued, on the other hand, that the brilliant mathematician might be handicapped in teaching at the Ordinary Level because he might be unable to see the difficulties only too apparent to lesser mortals. However, rather than depend on such hypotheses, we are on a sounder basis if we rely on the known tendency, proved by research, for there to be a positive relationship between academic qualifications and classroom teaching ability.

The extent of the positive correlation between academic achievement and teaching ability is so central to the argument presented in this article, that it needs to be considered at some length. In this country Lawton (1939), using training college students, found a correlation of 0.45 to 0.48 between academic examination grades and teaching assessment. Vernon, in a factorial analysis of the performance of 560 training college students, reported that teaching skill and marks in various subjects correlated from 0.43 in speech training to 0.17 in arithmetic. Research in America finds a similar relationship, correlations being usually in the range 0.3 to 0.4. For example Shan-

non (1941) found that the top third of graduates in scholarship were noticeably better in teaching skills than both the "average" and the failing thirds.

In order to get more up-to-date evidence the writer found the correlations between the practical teaching marks and the degree class of all graduates studying for the Diploma in Education in the University College of Swansea for the entry years 1961 to 1963. The resulting correlations were as follows. In 1961-2, for 90 students 0.25, in 1962-3 for 102 students 0.302, but in 1963-4 only 0.085 for 124 students. When these three figures were combined* the mean r for the 316 students was 0.203 (± 0.054). The low figure for 1963-4 requires comment. In that year the pressure of applicants on places increased and whereas most students with honours degrees were accepted on their academic performance, students with pass degrees were able to gain entry only if they had really good personalities for teaching or if their degree subject was in short supply. Pass students, therefore, being more finely selected on personality grounds, would tend to have a higher average teaching mark than would a truly representative sample of pass students, thereby reducing the correlation. This factor would probably be operating also in the two previous years, though to a lesser extent. Many pass degree students who failed to gain entry, together with some first-class degree students, would enter the profession without training. The students within the Department would therefore be more homogeneous than would the teachers in the schools and this factor would keep the correlation low between degree class and teaching mark for the Department students. Finally an examination was made of the relationship between the degree class of the mathematics students for all three years and their final teaching marks. This yielded a correlation of 0.24. Though there were only 26 cases, and the figure is therefore not statistically significant, it is given general support by the trend of research findings in this field.†

Although this agreement is too low for us to be able to say with confidence that a man with a good honours degree will be a good teacher, it is high enough to enable us to predict with certainty that any very large group of highly qualified grammar school teachers will on the average be better practical teachers than a similar group of lowly qualified teachers of the same subject, teaching at the same

* Using Fisher's z transformation.

† The correlation would again be kept low by the academic homogeneity of the sample, 18 out of the 26 students having pass degrees.

level. We should note that if the original gap between the two groups is according to academic qualification, the corresponding difference in the level of teaching ability will be much reduced, unless the standard of the subject matter taught becomes too difficult for easy comprehension by the less qualified teachers. When the subject matter is very simple there is little or no relationship between academic achievement and success in practical teaching (cf. Fuller (1946) with nursery school teachers). When the subject matter becomes more complicated the relationship becomes closer, cf. Knight (1922), who found that the correlation between intelligence tests and assessments of teaching efficiency was 0.446 for high school teachers but only 0.17 for elementary teachers. As the range of academic ability among the teachers of this survey is very wide, and as the level at which they are required to teach is fairly high, it seems reasonable to estimate that the correlation between their academic qualifications and their teaching ability would probably be somewhere between 0.3 and 0.4.

THE SAMPLES, AND CRITERIA

As explained in the introduction, the samples are not necessarily representative of the whole of England. They appear, however, to be reasonably representative of three areas, namely the West and North Ridings of Yorkshire, and Hertfordshire*; of these the two Ridings are combined in order to shorten the article. As, however, the results for Northern Ireland are included in a final combined table, the data which follows also includes that region. Returns were received from 222 schools out of 276, or 80.4 per cent. Of the replies 211 were usable (six were excluded as comprehensive schools, five were unusable). In all there were 1,036 teachers. The percentage of schools replying would have been greater except that some schools in the West Riding had recently participated in a somewhat similar survey (for a different purpose) and were understandably reluctant to complete a second form. Even here, however, the percentage of returns was 76.6, though the percentage for girls' schools was only 50. In the North Riding also the percentage for girls' schools was 50. On the other hand the percentage of returns from Northern Ireland was 87. Apart from the reasons already given for some schools failing to reply, we have only one check on whether the non-replying schools had a similar, better, or worse qualified staff of

* Data was also secured for Northern Ireland and published separately in *The Northern Teacher*, October 1965.

mathematics teachers than had the schools who replied, and that is that the schools who failed to reply until they received a gentle reminder were very similar to the others in the qualifications of their staffs.

As a check against possible pitfalls, three criteria of comparison were adopted. These were:

- (1) The average number of pupils per first-class honours degree in mathematics, and the average number per first- and second-class honours in mathematics.
- (2) The percentage of teachers of mathematics who had first- or second-class degrees, as above.
- (3) The degrees (in mathematics) of the highest and the second highest qualified teacher of mathematics in each school.

The figures are now summarised for each region, using the three criteria mentioned.

TABLE I
TEACHERS OF MATHEMATICS IN YORKSHIRE (EXCEPT EAST RIDING) (JAN. 1962)*

No. of Schools		Pupils per Teacher				Teachers' Degrees		
		Hons. Class I	Pupils per Class I	Hons. I and Hons. II	Pupils per Classes I and II	Number Teaching Maths	% with Class I	% with Classes I and II
Boys' schools	44	28	847	79	300	242	11.6%	32.6%
Girls' schools	40	11	1,957	44	489	179	6.1%	24.8%
Mixed schools	36	14	1,566	54	429	187	7.5%	28.9%

* Teachers with pass degrees in Mathematics and another subject are classed as "Pass"; degree in another subject (whatever class) is classed as "Others", together with qualifications like a Teacher's Certificate; a few Class I teachers had General Degrees including Mathematics.

The boys' schools are appreciably better staffed than the others, particularly when the criterion is the number of pupils per honours graduate as above. In second place, but appreciably behind, are the mixed schools, while in this instance the girls' schools appear only a little less well staffed than the mixed. Things, however, are not always what they seem to be, and another factor must be brought into consideration. A much smaller proportion of girls in girls' schools take mathematics, especially in external school examinations, than do pupils in mixed and boys' schools. They do not therefore

TABLE II

YORKSHIRE (EXCEPT EAST RIDING): DISTRIBUTION OF THE HIGHEST
AND SECOND HIGHEST QUALIFIED TEACHER OF MATHEMATICS
IN EACH SCHOOL

		<i>Degree qualifications in mathematics</i>				
		<i>Honours</i>				
		<i>I</i>	<i>II</i>	<i>III</i>	<i>Pass</i>	<i>Lower</i>
Boys' schools						
Maintained (32)						
Highest		12	12	5	3	0
Second highest		4	12	2	10	4
Independent and Direct						
Grant (12)						
Highest		4	8	0	0	0
Second Highest		2	3	0	5	2
TOTALS (44)		16	20	5	3	0
	Highest	6	15	2	15	6
	Second highest					
Girls' schools						
Maintained (32)						
Highest		7	17	3	2	3
Second Highest		0	10	4	11	6
Independent and Direct						
Grant (8)						
Highest		2	1	0	1	4
Second Highest		1	1	0	2	3
TOTALS (40)		9	18	3	3	7
	Highest	1	11	4	13	9
	Second highest					
Mixed schools						
Maintained (36)*						
Highest		12	19	3	2	0
Second Highest		1	13	11	7	3

* Includes one Class II Hons. from one independent school. Three rows do not add up to the number of schools because a few schools were not large enough to have a second teacher taking mathematics.

need quite as high a proportion of mathematics teachers per pupil. (We are not concerned here with the possibility that a better quality staff might improve the percentage taking mathematics.) It could be argued also, though not with the same cogency, that as girls' schools have a much smaller percentage of examination pupils than have mixed or boys' schools, much of the work is with junior and middle forms, hence the proportion of Class I and Class II graduates can justifiably be lower. However, girls' schools may rightly retort that the mathematics of any grammar school is probably impoverished if it has no honours graduate of Class II or better.

In Table II the criterion of the qualifications of the best and second best qualified teacher in each school is used.

In this table, although the boys' schools come out best at the top end, they seem to be rather weaker than the mixed schools at the bottom end. Slightly less than a quarter of the girls' schools have a first-class graduate as their best qualified teacher of mathematics, whereas the corresponding figure for mixed schools is one third and for boys' schools rather more than a third. No less than a quarter of the girls' schools had a teacher with a pass degree or lower qualification as their best qualified teacher, whereas only one eighteenth of the mixed schools and about a fifteenth of the boys' schools are so placed. An overall consideration of all three criteria places the boys' schools clearly in front, with mixed schools second and the girls' schools third.

We now turn to the third region, Hertfordshire.

TABLE III
TEACHERS OF MATHEMATICS IN HERTFORDSHIRE (JAN. 1962)

No. of Schools	Pupils per Teacher				Teachers' Degrees		
	Hons. Class I	Pupils per Class I	Hons. I and Hons. II	Pupils per Classes I and II	Number Teaching Maths	% with Class I	% with Classes I and II
Boys' schools 11	10	544	22	247	63	15.9%	34.9%
Girls' schools 24	8	1,142	31	295	86	9.3%	36.0%
Mixed schools 14	6	1,266	31	246	65	9.2%	47.7%

Here the position is not quite the same as in the other regions. Although the boys' schools have a very big lead in the proportion of

TABLE IV

HERTFORDSHIRE: DISTRIBUTION OF THE HIGHEST AND SECOND HIGHEST QUALIFIED TEACHER OF MATHEMATICS IN EACH SCHOOL

		Degree qualifications in mathematics				
		Honours			Pass	Lower
		I	II	III		
Boys' schools						
Maintained (4)						
Highest		2	2	0	0	0
Second Highest		0	1	1	2	0
Independent and Direct Grant (7)						
Highest		4	3	0	0	0
Second Highest		3	2	0	0	1
TOTALS (11)		6	5	0	0	0
Highest		3	3	1	2	1
Second highest						
Girls' schools						
Maintained (8)						
Highest		2	6	0	0	0
Second highest		1	2	2	3	0
Independent (16)						
Highest		3	6	2	2	3
Second highest		1	4	1	3	3
TOTALS (24)		5	12	2	2	3
Highest		2	6	3	6	3
Second highest						
Mixed schools						
Maintained (11)						
Highest		3	8	0	0	0
Second highest		1	7	0	2	1
Independent (3)						
Highest		2	0	1	0	0
Second highest		0	0	1	0	1
TOTALS (14)		5	8	1	0	0
Highest		1	7	1	2	2
Second highest						

teachers with first-class degrees the mixed schools draw level with them in the number of pupils to teachers with Class I and Class II degrees, and even pass them when teachers with such degrees are reckoned as a proportion of the mathematics teaching staff. Though the girls' schools are distinctly inferior to the boys' in their proportion of teachers with first-class degrees, they come close to the mixed schools. With Class II degrees included, however, they fall a little behind the mixed schools; on the other hand, while they are still appreciably behind the boys' schools in the number of pupils to teachers with Class I and Class II degrees, they even slightly pass them in the percentage of their mathematics staff who have such degrees. On a general appraisal of the position the boys' schools lead, with the mixed and girls' schools very close together. The analysis according to the degrees of the highest and second highest qualified teacher sheds some fresh light on the picture (Table IV, p. 117).

We see that just over a half of the boys' schools have a first-class honours graduate as their highest qualified teacher, but only a third of the mixed schools and a fifth of the girls' schools. Whereas no boys' school has a teacher in charge of mathematics who has a degree lower than Class II, there is one mixed school (out of 14) so placed, and almost one-third of the girls' schools. This method of analysis shows more clearly the weak points in the staffing of the girls' schools and places them again third.

When the data for the three regions is tentatively combined the following picture emerges:

TABLE V
NORTHERN IRELAND, YORKSHIRE (EXCEPT EAST RIDING) AND
HERTFORDSHIRE: DISTRIBUTION OF TEACHERS OF MATHEMATICS

	<i>Pupils</i>	<i>Pupils per Hons. I</i>	<i>Pupils per Hons. I and II</i>	<i>% teachers Hons. I</i>	<i>% teachers Hons. I and Hons. II</i>
<i>Maintained schools</i>					
Boys'					
Girls'	21,114	1,005	352	10.1%	28.8%
Mixed	24,189	2,199	432	5.2%	26.3%
<i>Voluntary, Independent, and Direct Grant schools</i>	32,785	1,639	353	6.7%	31.1%
Boys'					
Girls'	12,863	559	207	15.6%	42.2%
Mixed	11,224	1,020	401	10.2%	25.9%
	6,737	842	269	13.1%	41.0%

The Table shows that whichever criterion is used the boys' schools, both maintained and non-maintained, are better provided with mathematicians who have first-class honours degrees than are the girls' and mixed grammar schools. In second place, a long way behind, are the mixed schools, and the girls' schools bring up the rear; the gap between the boys' and mixed schools is a little larger than that between the mixed and girls' schools. When Class I and Class II graduates in mathematics are combined, the mixed schools draw level with the boys'. (Within this criterion, of course, the boys' schools still retain their superiority in the proportion of Class I degrees.) Using the same criterion, the girls' schools draw up much closer to the other schools (with the above reservation) except in the non-maintained sector. When assessing this position, however, we must remember, as mentioned before, that the girls' schools in comparison with the others have a much smaller proportion of pupils taking mathematics, and in particular a much smaller proportion of pupils taking mathematics for the first and second external examinations. Unfortunately this is a rather vague factor for which it is difficult to allow, but we have seen something of its effect in N. Ireland (Dale, 1965), and examination statistics show us that the pattern is general. The one certain fact which emerges is that the boys' schools are better staffed than either the mixed or girls' schools. The apparent difference between the girls' and mixed schools is reduced when regard is paid to the lower percentage of pupils who take mathematics, particularly in external examinations in girls' schools.

What effect does this distribution of mathematics teachers have on the findings of past research on the comparative attainment of boys', girls' and mixed schools in mathematics at the level of the first external examination? In the case of Northern Ireland it shows that the distribution was probably a hidden variable handicapping the girls' schools, to what extent we do not know. If we use this argument, however, it is also applicable to the mixed schools vis-à-vis the boys', and as the boys in mixed schools reached a rather higher standard than their counterparts in the boys' schools in Sutherland's inquiry (1961) this must have been in spite of them having less highly qualified teachers, a fact which has not been reported previously. The argument also applies to any comparison of attainment between girls' and mixed schools in other subjects, in most of which the staffing position is likely to be reversed. Finally, this data compares the *attainment* of groups of teachers; the differences between them

in *teaching efficiency* will probably be less wide than are those in attainment.

4. ADDENDUM

In this addendum the main theme of comparison between single-sex and co-educational schools is put on one side in order to present some comments from Heads which illustrate the scarcity of well qualified teachers of mathematics. Readers will notice that they are all from girls' and mixed schools but should not deduce that all boys' schools are suitably staffed in mathematics. First the comments from girls' schools:

"Our best Maths teacher went to N.Z. last year. I had *one* application, fortunately a fairly good one."

"An honours graduate in Physics, when appointed, had to teach all advanced mathematics because nobody else on the staff then was able to do it."

"This school last had a teacher qualified to be Head of Dept. in Maths in July 1952."

"Failed degree in Maths but is excellent teacher."

"A pass graduate is in charge of the Mathematics Department. No honours graduate applied for the post in spite of the P.S.R. allowance."

"I had to fill in with an unqualified teacher as I had appointed her before she sat for finals (and failed one paper). She had enough for the Ministry to sanction appointment unqualified."

Then the co-educational schools:

"For five years we were without Head of Department. No. 2, offered it, declined post not wanting responsibility. We usually have to ask our Physics and Chemistry teachers to do either four periods of Advanced Senior work per week or one Junior Form for the year."

"I had no applications for a new Maths-Physics post needed owing to increased numbers."

"Owing to increased numbers I needed a third full-time teacher and received one application, from a third-class honours holder."

"There is no main honours specialist in Mathematics in the school. The last effort to advertise for one produced only a graduate in Engineering. The best pupils are not receiving the broad fundamental approach to Advanced Level Study in Mathematics, so necessary for ground work in the Faculties of Science and Applied Science at Universities."

Educationists have been wondering why there are vacant places

in the Faculties of Pure Science and in Engineering at the universities. Here appears to be at least part of the answer. Mathematics is not only an important subject in its own right, it is also an indispensable tool for good work in physics and in chemistry. If the teaching in mathematics is poor it is not only the attainment which suffers: pupils become discouraged and turn to other subjects. This is a process which may have its beginnings even in the junior forms and act throughout the school. It may be that this is happening in many of the nation's schools.

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SOME ISSUES RAISED BY A NON-VERBAL TEST OF NUMBER CONCEPTS

by J. G. WALLACE

Research Fellow, Institute of Education, University of Bristol

I. INTRODUCTION

PIAGET has frequently been criticised for his use of verbally posed problems and for his reliance upon interpretation of verbal responses in his approach to the study of concept formation. By making frequent use of verbal stimuli the experimenter becomes involved simultaneously with the problems of the conceptual process and the equally difficult questions posed by the relationship between language and conceptualisation. The ensuing confusion considerably reduces the possibility of arriving at results of value. The child presumably responds to the "meanings" which he attributes to the experimenter's words. What these meanings are we do not know; we know only that they are intimately related to the events and circumstances surrounding the child's original learning of them. The verbal method may, therefore, only serve to conceal the effective stimulus for the subject's response.

The dangers of inferring a child's level of conceptual development from verbal responses are, also, very obvious. Berko and Brown (1) pointed out that when Piaget deduces his subjects' conception of quantity from their referential use of words like "more", "less", and "equal" it would be at least as accurate to say that his study is concerned with their understanding of the vocabulary of quantity. Evidence of the pitfalls involved in the interpretation of verbal responses is provided in the studies of Smedslund (2) and Milgram and Goodglass (3).

That the way in which questions are worded materially affects the results obtained has been attested to by such investigators as Nass (4), King (5), and Lovell, *et al.* (6). Criticism of the verbal method from this angle has been carried further by Braine (7) who asserts that it would seem to be intrinsically impossible to study how

a concept develops with methods which employ verbal cues to evoke the concept. If the child understands the verbal cue, he must already have developed the concept. If he responds more or less appropriately, it is certain that he has the concept, but, if he fails to do so, very little is learned. The course of development of the concept remains obscure, and no light is thrown on the variation with age in the learning and generalisation processes on which conceptual development depends.

To accept these criticisms is to accept the necessity for the application of non-verbal methods to the study of conceptualisation. Braine (8), the Kendlers (9) and Wohlwill (10) have all taken this step and have applied themselves to the task of adapting for use with children non-verbal tasks which were developed initially in animal laboratories. Wohlwill's work on the development of number concepts provides the point of departure for the present study. The aim was the selection of children for inclusion in an investigation of the relative effectiveness of a verbal and a non-verbal method of accelerating the attainment of number conservation. With this in view, the subjects underwent parallel verbal and non-verbal tests of number concepts. Our main concern at the present time is with the latter.

2. THE SAMPLE

The subjects were two hundred and twenty-seven children drawn from four Bristol schools with nursery classes and widely differing socio-economic backgrounds. The children were divided into three age groups. Thirty-seven (25 girls, 12 boys) were between 4.0 and 4.6 years, ninety-seven (50 girls, 47 boys), between 5.0 and 5.6 years, and ninety-three (47 girls, 46 boys), between 6.0 and 6.6 years.

3. THE TEST

The non-verbal test of number concepts used was based on that of Wohlwill (10). This was preferred to Wohlwill's (11) later version on the grounds that the latter involved the making of a match between a given collection of elements and the corresponding symbolically indicated number, while the former paralleled the verbal test to be used (Dodwell, 12) in that it entailed appreciation of the equivalence of the numerosity of two collections of elements.

(a) Apparatus

This consisted of an aluminium sheet (18×12 in.) mounted vertically on a base of the same material. Three rectangular apertures ($4 \times 2\frac{1}{2}$ in.) separated by intervals of $2\frac{1}{2}$ in. were cut in the centre

of the sheet in a horizontal row. These apertures were approximately at eye level for a subject seated in front of the apparatus and were covered with doors which opened upwards towards the child. Behind each door there was a ledge on which the experimenter could place the small, coloured, wooden blocks with which correct responses were reinforced. Each door was, also, equipped with two projections on which cards were hung.

(b) *Administration*

Initial Practice Trial. Three choice cards were hung on the doors in the presentation apparatus. These comprised, from left to right, two blue dots arranged horizontally, three blue dots forming an isosceles triangle, and two purple concentric circles. The sample card, which was placed on the table in front of the apparatus, also showed two purple concentric circles, though somewhat larger than those of the third choice card.

The experimenter told the child that he wanted to play a game with him. He would hide a block behind one of the doors and the subject was to try to find it and string it with the other blocks on a wire with which he had been provided. He would be able to find the block every time if he looked carefully at the (sample) card and then at the (choice) cards on the doors, for they would tell him which was the correct door. The child was now allowed to choose and open one of the doors. If this initial choice was incorrect, he was permitted to correct it until he found the block. He was, also, urged to look very closely at the cards, since there was something on them which would tell him which door had the block behind it. This correction procedure applied only to this single practice trial.

Training Series. After the practice trial, the choice card with the concentric circles was replaced with one showing four blue dots in a diamond arrangement. The three choice cards, thus, represented the numbers two, three and four, respectively, from left to right on the doors. These choice cards remained in place throughout the training series.

The training series involved the use of a set of eighteen sample cards, carrying two, three and four dots in varying configurations, none of which was identical to any of the choice cards on the doors. As in the practice trial, the sample cards were placed, one at a time in random order, on the table directly in front of the apparatus. The subject was not, however, permitted to correct wrong choices. The criterion of learning was six consecutive correct responses; if this

criterion was not met in forty-eight trials, the child did not undergo the test series.

Test Series. 1. Extension Series. In this test the range of numbers being used was extended. Six, seven and eight dots were shown on the choice cards as well as, in varying configurations, on the sample cards. Procedurally, this test constituted an extension of the training series.

2. Conservation of Number (Unprovoked Correspondence). For this test the choice cards from the previous test, representing the numbers six, seven and eight, were retained. A number of plastic counters, however, were employed instead of the sample cards. At the start of each trial, the counters were arranged in a pattern exactly duplicating the configuration of the dots on the corresponding choice card. The subject was instructed to look at the counters, because there was one card which looked just like them. He then made his choice. Since the purpose of this preliminary choice was only to inform him of the choice card whose dots were in numerical correspondence with the set of counters, the experimenter prevented him from carrying out an incorrect choice by stopping him short if he moved to open the wrong door. He was asked to try again and urged to look carefully at the card. These preliminary choices were not scored. After the information portion of the trial, the experimenter scrambled the counters by hand in full view of the subject, and calling his attention to this rearrangement of them. The child then responded anew to one of the doors.

The last part of this procedure was a departure from Wohlwill's (10) practice. He believed that it was necessary to cover the counters after the act of scrambling to prevent the subject from recounting them and, thus, succeeding on the scored trial without truly conserving. Covering the rearranged counters was rejected in the present study because it seemed to limit the variety of modes of approach which the children could adopt to the problem and, thus, would result in a loss of potentially valuable developmental data. In addition, it was considered that success by recounting could be detected by careful observation of the subjects' verbalisations, lip and hand movements, and of the difference in the time taken to make the scored response. Covering the counters, also, places a burden on the subjects' short term memory and, thus, makes the task of interpreting fail responses all the more difficult since they may be due to memory lapses rather than to inadequate conceptual development.

3. Addition and Subtraction (Unprovoked Correspondence). This test consisted of a set of trials similar to those of the previous

test, with which they were interspersed in the following order: c (=conservation); a (=addition); c; s (=subtraction); a; c; s; s; c; a; c; c. The only difference between Tests 3 and 2 was that in Test 3 one counter was either added to or subtracted from the collection in front of the subject, immediately after his initial configurational match and just before the experimenter disarranged the counters. In either case, the experimenter alerted the child to the action which he was taking.

4. Provoked Correspondence. This test was identical in administration to Test 2 and 3 and, like them, comprised twelve addition, subtraction and conservation trials. The choice cards, however, depicted six, seven and eight egg-cups and the counters were replaced with toy eggs.

All the tests consisted of six reinforced trials with the exception of Test 1 (Extension Series) which was presented for twelve trials in order to provide adequate familiarisation with the choice cards for the following conservation and addition-subtraction tests. To facilitate comparison the arbitrary criterion used by Wohlwill (10) for determining the number of passes on the individual tests was adopted. This was five correct responses out of six trials and ten out of twelve on Test 1.

4. RESULTS

Thirty-one of the original two hundred and twenty-seven subjects failed to reach the criterion of six consecutive correct responses in the Training Series and were dropped from the study. Of this group sixteen (9 girls, 7 boys) belonged to the 4.0-4.6 years group, twelve (3 girls, 9 boys) to the 5.0-5.6 years and three (1 girl, 2 boys) to the 6.0-6.6 years group.

The order of difficulty of the tests as judged by the total number of subjects who attained the pass level is indicated in Table I. As the results of the present study are closely bound up with developmental issues, any variations in the order of difficulty of the tests from age group to age group are of extreme importance. Table I also comprises a breakdown of the pass frequency figures into age group totals. To preserve the parallel with Wohlwill's work, Loevinger's (13) co-efficient (H_{ii}) was accepted as an index of the homogeneity of each test with the total scale. It reveals the extent to which a test scales with the set as a whole, in terms of power to discriminate subjects with a relatively higher total score from subjects with a relatively lower total score.

TABLE I

FREQUENCY OF PASSES ON TESTS AND HOMOGENEITY (H_{it}) OF TESTS WITH TOTAL SCALE

H_{it}	Tests				
	Add-Sub. (Prov.)	Add-Sub. (Unprov.)	Conser. (Prov.)	Conser. (Unprov.)	Exten. Ser.
	0.88	0.86	0.97	0.95	0.97
4.0-4.6 Years Group	4	4	0	1	1
5.0-5.6 Years Group	37	37	31	27	26
6.0-6.6 Years Group	70	67	74	65	64
Total Number of Passes	111	108	105	93	91

In addition to total and sub-test scores a detailed account of performance, including observations on verbalisation and other lip movements, hand movements, and delays in responding, was available for one hundred and seventy-nine of the subjects. This data revealed that, as anticipated, a number of the subjects overtly counted the counters or eggs after they had been rearranged and before making their scored conservation test responses. The frequency of the adoption of this mode of approach in relation to the children's age group and total conservation score is given in Table II.

TABLE II

FREQUENCY OF OVERT COUNTING BEFORE SCORED CONSERVATION TEST RESPONSES

FREQUENCY	TEST RESULTS												
	Conservation Score												
	0	1	2	3	4	5	6	7	8	9	10	11	12
4.0-4.6 Years Group	0	0	0	0	0	0	0	0	0	0	0	0	0
5.0-5.6 Years Group	0	0	1	2	2	2	0	1	1	3	2	4	4
6.0-6.6 Years Group	0	1	0	0	0	0	0	2	0	1	2	8	11

These results support the view that the attain

The results of the present study support the view that the attainment of conservation constitutes a definite landmark in the growth of number concepts. The subjects' scores in both unprovoked and provoked conservation tests (Tests 2 and 4) yielded a U-shaped frequency distribution, with a mode at six, which is consistent with an all-or-none character for the concept being tapped.

5. DISCUSSION

In considering the results of the conservation and addition-subtraction tests attention will be mainly devoted to Tests 2 and 3 in which the correspondence between the counters and choice cards was unprovoked or spontaneous. This will be done since, except at points which will be indicated, the results of Test 4, in which the materials were qualitatively complementary and correspondence was provoked, are entirely in accordance with those of the earlier tests. That the provoked correspondence totals are higher than the unprovoked totals is in line with expectations based on the order of administration of the tests and the difference in the materials employed. The superiority is most marked in the results of the six-year-old group and this may be attributed to a greater ability to benefit from practice or to an interaction between the subjects' level of numerical competence and the difference in the test materials.

More remarkable are the relative positions in order of difficulty of the extension series, conservation and addition-subtraction tests. The critical ratio associated with the difference between the proportion of subjects passing the unprovoked addition-subtraction test (Test 3) and the extension series is 2.67 ($P < 0.01$). The greater ease with which the subjects dealt with the addition-subtraction test is surprising since, theoretically, it demands all of the symbolic operations involved in the extension series and, also, an understanding of the relationship between adjacent numbers involved in operations of the type $x + 1 = y$.

A consideration of the relative performance of the three age groups suggests a possible explanation. In the six-year-old group the number of subjects who passed the unprovoked addition-subtraction test is not significantly superior to the number of passes on the extension series. In addition, seven of the ten children who failed the extension series and passed the addition-subtraction test would have passed the former if the high arbitrary criterion of ten correct responses had been lowered to eight correct responses. These subjects were clearly working on a numerical basis but found accurate counting more difficult in the extension series, where there was no perceptual correspondence between the choice and sample cards, than in the addition-subtraction test in which there was exact perceptual correspondence between the counters and choice cards on the initial match.

In the five-year-old and four-year-old groups, fourteen and four subjects respectively failed the extension series and passed the un-

provoked addition-subtraction test. Only two five-year-olds and none of the four-year-olds would have passed the extension series on the suggested revised criterion. The scores of the remainder were sufficiently low to suggest that it was highly probable that they had not been working on a numerical basis at all. Although Wohlwill (10) admitted that a successful response on the training series might only indicate a discriminative capacity of a fairly primitive order, he proceeded with the rest of the tests on the assumption that success could only be achieved if the subjects adopted a number matching set. This is highly problematical since a subject who attains the training criterion by matching the sample and choice cards on the basis of purely perceptual cues (such as, for example, total stimulus area or extent of figure-ground segregation) is easily able to find the correct door on the initial trials of the addition-subtraction test as there is an exact configurational correspondence between the counters and the choice cards. A high measure of success on the scored responses can then be achieved, entirely without numerical working, by making choices guided by a simple, empirical rule such as "the correct door is always a different one from the one which is correct the first time". This would give a $\frac{1}{2}$ chance of responding to the correct door on each trial.

Eight of Wohlwill's subjects, also, failed the extension series and passed the unprovoked addition-subtraction test. The explanation which he offers of this finding cannot be regarded as the most parsimonious. He comments that "on the lowest level, success on this test was based less on a precise realisation of the arithmetical relationships involved than on a possibly still rather intuitive perception of the order among the choice cards, and of the effects of addition and subtraction".

Although equally open to this type of approach, there is less evidence of success achieved in the unprovoked conservation test by an empirical rather than a numerical attack. Its high homogeneity with the total scale provides a general indication of a largely numerical approach by the subjects. Only 9 six-year-olds, 7 five-year-olds and a single four-year-old failed the extension series and passed the unprovoked conservation test. Eight of the six-year-olds and one of the five-year-olds would have passed the extension series if a less stringent criterion of eight correct responses had been adopted. The remaining six-year-old and a further five-year-old were among the group who overtly counted the counters before making their scored conservation test responses. This leaves six of the younger subjects who gave no apparent evidence of numerical working and may have

succeeded on the unprovoked conservation test by employing an empirical rule such as "the correct door is the same on both choices".

An interesting developmental issue is raised by the greater total of passes on the addition-subtraction than on the conservation tests. The result is contrary to expectations based on an analysis of the numerical operations involved since addition-subtraction trials appear to entail a grasp at a symbolic level of the relationships among numbers which does not seem to be demanded by the conservation trials. On the basis of a similar, statistically significant critical ratio, Wohlwill (10) asserted that success on the addition-subtraction trials appeared to be virtually a prerequisite for the manifestation of conservation and that interspersed with the conservation trials they had the effect of suggesting to the subject the conservation of the number aggregate in the conservation trials, where no element was either added or subtracted but only the perceptual configuration was changed.

Although this assertion about the course of the development of conservation of number derives a certain amount of support from the results of studies by Williams (14) and Churchill (15) and the modest success reported by Wohlwill (11) in establishing the notion of conservation by repeated exposure to the effects of addition and subtraction, it is extremely doubtful if Wohlwill's (10) results and those of the present study can be reconciled with it. Twelve of Wohlwill's subjects passed the addition-subtraction test and failed the conservation test. Six of these subjects, however, although failing to achieve the pass criterion of five correct responses, gave definite evidence of conservation in that, after responding incorrectly on the first two or three trials, they made correct responses on the last four or three trials. As Wohlwill does not provide details of individual performance on the extension series, it is not possible to assess how many of the six remaining subjects were clearly functioning on a numerical rather than an empirical basis.

In the present study, 7 six-year-olds, 12 five-year-olds and 3 four-year-olds passed the unprovoked addition-subtraction test and failed the unprovoked conservation test. Only one of the six-year-olds and two of the five-year-olds gave definite evidence of conservation although failing to achieve the pass criterion. The comparatively large numbers of subjects remaining might seem to support Wohlwill's views on the sequence of development but a consideration of their scores on the extension series deprives this evidence of its validity. All three of the four-year-olds, seven of the five-year-olds

and one of the six-year-olds scored six or less correct responses on the extension series. It is thus highly uncertain that these subjects were employing a numerical set in tackling the tests. The performance of the 5 six-year-olds and 3 five-year-olds who were clearly working on a numerical basis and who passed the addition-subtraction test and failed the conservation test still seems to support Wohlwill's viewpoint. This evidence is counterbalanced, however, by the performance of the 5 six-year-olds and 2 five-year-olds who failed the addition-subtraction test and passed the conservation test. With the exception of a single five-year-old, all of these subjects were clearly working on a numerical basis since one scored twelve correct responses on the extension series, two scored eleven, one scored ten and two scored nine and eight respectively.

Other features of the results are inconsistent with Wohlwill's assertion. At the six-year-old level where most of the subjects were clearly working with a numerical set the total number of subjects who passed the unprovoked addition-subtraction test was only slightly, and not significantly, greater than the total of those who passed the unprovoked conservation test. In addition, although the results obtained in the addition-subtraction and conservation tests with the provoked correspondence materials were, in general, very similar to those obtained with the unprovoked correspondence materials, at the six-year-old level the number of passes on the provoked conservation test was slightly, but not significantly, superior to the number of passes on the provoked addition-subtraction test.

In short, although an appreciation of the effects of addition and subtraction is evidently closely linked to the appearance of conservation of number, neither Wohlwill's (10) results nor those of the present study give clear grounds for regarding the former as a prerequisite for the development of the latter. Indeed, the results of the present study suggest that the concept of conservation would be more likely to be established in children by presenting them with both addition-subtraction and conservation trials in a mixed sequence than by repeated exposure to the effects of addition-subtraction alone. Support for this viewpoint is provided by the work of Smedslund (2) on accelerating the development of conservation of weight in children aged from five to seven years.

The marked increase, revealed in Table II, in the frequency of adoption of the overt counting approach with the rise in the subjects' total conservation score and age can hardly be regarded as surprising. It does, however, have some interesting developmental implications.

In general, it suggests the existence of a close connexion between the use of counting by the children and their attainment of conservation. We can be more specific. Two variations of the counting approach were observed. Some of the subjects counted the counters or eggs before making the initial choice and then, after they had been rearranged, proceeded to recount them before making their scored responses. Others gave no evidence of counting on the initial match but, after the elements had been rearranged, counted before making their scored responses. The behaviour of the former group is consistent with the interpretation that they have discarded the perceptually dominated approach which produces non-conservation and clearly realise the relevance of enumeration to the situation. The concept of conservation is not yet sufficiently established, however, for them to accept it as logically necessary that, in the absence of addition or subtraction of an element, the number of objects in the collection must be unchanged. They are, therefore, obliged to recount the elements in the group to make sure of this fact. The latter group, also, appreciate the relevance of enumeration. That they do not apply it in making the initial match appears to be due to the realisation that the correct response can easily be determined by relying on the obvious one-one correspondence between the counters or eggs and the arrangement of the elements on the appropriate choice card. They do find it necessary, however, to resort to counting to discover the correct response on the conservation trial.

These findings are not consistent with the features stressed by Piaget (16) in his account of the genesis of conservation. His account is based on the results obtained in a series of highly verbal test situations in which, as in the present study, the establishment of an initial one-one correspondence between the elements of two equal collections was followed by a disruption of the perceptual configuration of one of them. In it he asserts that the reasoning which leads to the affirmation of conservation essentially consists of co-ordination of relations with its twofold aspect of logical multiplication of relations and mathematical composition of parts and proportions. The child is able to co-ordinate the displacements made in the elements of the disturbed collection and realises, for example, that although they may have been pressed together and occupy a smaller area they have not become fewer since the change has been offset by a corresponding increase in their density. He realises that the spatial modification in the distribution of the elements can be corrected by an inverse operation which would restore the original correspondence. Thus, it is

the development of the ability to employ logical multiplication of relations and reversible operations in his thought processes that enables the child to establish the quantifying operational correspondence which guarantees the necessary and lasting numerical equivalence of corresponding sets in spite of changes in their appearance.

Piaget accords little importance to counting in the evolution of conservation. He asserts that there is no connection between the acquired ability to count and the actual operations of which the child is capable. At the point at which correspondence becomes quantifying, thereby giving rise to the beginnings of equivalence, counting aloud may hasten the process of evolution but the process is not begun by numerals as such. The results of the present study not only suggest that Piaget may have underestimated the part played by counting in the development of conservation but, also, that he may have overemphasised the rôle played by appreciation of the multiplication of relations. If his claims for the importance of multiplication of relations are justified it is particularly difficult to explain the behaviour of the subjects who made their initial choice on the basis of one-one correspondence and yet found it necessary to resort to counting before making their scored responses. This suggests that one-one correspondence may have to be linked with counting before necessary equivalence is accepted. Renwick (17) quotes examples of children's responses which indicate that the establishing of one-one correspondence is not at first regarded as giving valid information about the relative number of objects in two collections. It is only when the act of pairing becomes connected with the familiar operation of counting and the use of the well-known verbal sequence that its numerical significance is appreciated and it is accepted as a valid alternative to counting as a source of numerical information.

Two further points support the suggestion that counting may have a fundamental rather than an ancillary rôle to play in the development of conservation. Piaget's account is based on a series of test situations in which the subject is called upon to deal simultaneously with two collections of elements. This, however, is not structurally the simplest situation in which children's appreciation of conservation can be tested. The simplest approach would involve confronting the subject with a single collection of elements and testing his grasp of the invariance of the number in the group despite changes in the position of the elements. The fundamental part played by counting in the development of conservation is very evident in this situation since the child must employ counting to establish a correspondence

between the elements in the collection and the units of the familiar verbal sequence before the initial situation necessary for the investigation of conservation can be established.

The importance of counting is, also, emphasised if we accept the suggestion made by Churchill (15) that it is through repeated counting acts, particularly if accompanied by finger pointing as they often are, that the child becomes aware of the units comprising a group, one of the basic factors necessary to the number concept. The realisation is vital for the appearance of conservation. The child must be aware of the units comprising a group before he can discard the global or perceptual method of reaching numerical decisions and become capable of employing the critical test for conservation—that at least one element must be added to or subtracted from a collection before the number changes.

6. SUMMARY OF RESULTS AND CONCLUSIONS

(a) The non-verbal test of number concepts described is suitable for the main purpose for which it was employed in the present study, namely the selection of children who have not yet attained conservation of number. This conclusion is justified by the U-shaped frequency distribution of the conservation scores and the comparatively slight evidence of success achieved by an empirical rather than a numerical approach on the conservation items.

Substantial procedural modifications are necessary, however, before the test can fulfil its potential as an instrument for revealing the course of the development of conservation. Success attained by the employment of an empirical rule must be eliminated. The cards employed in the training series could have six, seven and eight dots rather than two, three and four. This would greatly diminish the likelihood of a subject attaining the training criterion by matching the sample and choice cards on the basis of purely perceptual cues. It would also permit the dropping of the extension series and a desirable shortening of the test. The achieving of success on addition-subtraction and conservation trials by employing empirical rules based on the sequence of doors rewarded could be eliminated by changing the relative positions of the choice cards over the doors after the subject's initial match and before his scored response. This would make it possible for a different door to be rewarded on a conservation trial and the same one on an addition-subtraction trial.

(b) Although an appreciation of the effects of addition-subtraction is closely linked to the appearance of conservation of number, the

results of the present study do not provide clear grounds for regarding the former as a prerequisite for the development of the latter.

(c) It is suggested that Piaget may have underestimated the part played by counting in the development of conservation and over-emphasised the rôle played by appreciation of the multiplication of relations.

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A COMMENTARY ON CERTAIN FEATURES RELEVANT TO THE PRESENT STATE OF PROGRAMMED INSTRUCTION

by DERICK UNWIN
*Bulmershe College of Education**

I. INTRODUCTION

OF recent years, a great deal of interest has been focused on the techniques of programmed instruction. Leith (1963) gives an overview of research, from which it is evident that conflicting or indeterminate results have commonly been obtained by investigators. Many of the reported studies suffer from using programmes which are too short, and from failing to hold variables constant. The purpose of this paper is to review some of the factors considered necessary in the construction and use of programmes, and to suggest lines of research which may help in deciding why auto-instruction succeeds, and how it may be improved.

2. SYNTHESIS AND ANALYSIS OF PROGRAMMES

In order to obtain a prescription for programme writing an obvious step is to examine programmes of known worth and thus isolate common elements. A drawback attending this line of approach is that if certain features become in course of time entrenched, programming may tend to be cast into a stereotyped mould. This criticism vanishes if the results are reinforced by incorporation into a proven theory of learning, rather than being left as an empirical set of programming rules. As will be argued below, it is a debatable point whether learning theory can at present offer very much guidance to programme construction.

Methods of programme analysis have been proposed by Becker (1963) and Hartley (1964). However, these suggestions are primarily intended for tyro-programmers as an aid for examining their own programmes. In essence they go little further than the identifica-

* At present at Nottingham University Institute of Education.

tion of various types of frame. Although analysis of this type is easily carried out it seems of little value for distinguishing between good and bad programmes.

Periodically attempts are made to establish prescriptions for the successful writing of auto-instructional programmes; various justifications are given by authors in support of their systems. Skinner (1958) puts forward a rationale based on experimental results from the psychological laboratory. Crowder's (1960) branching technique is based on various pragmatic rules arising out of his own experience. More formal prescriptions are proposed by Evans, Glaser and Homme (1962a) who suggest a "Ruleg" system which depends on the establishment of certain rules implicit in any subject matter, and by Thomas *et al.* (1963) whose extremely formal methods include the construction of "flow-diagrams" as well as matrices.

Any method of analysis or synthesis implicitly contains two assumptions:

(a) that programmed learning materials are susceptible to such treatment,

(b) that there is some point in carrying out such analysis or synthesis.

Now (b) is certainly invalid unless (a) is true. One purpose of this paper is to argue that so far as our present state of knowledge is concerned, programmed learning materials can neither be effectively analysed nor synthesised.

When an author proposes to lay down criteria for programme writing, there are two ways in which he can justify his rationale; he can either submit that programmes constructed according to his ideas are superior in performance to other programmes; or he can bring forward results from experimental psychology and demonstrate that his mode of construction is based on solid research foundations or valid theories. Most workers would prefer the first of these alternatives because there is by no means universal agreement on the relevance of much behaviourist theory to the human learning situation.

In fact the basic rationale of most programming prescriptions is that any system is better than no system. This probably arises from the urge to train programmers before we know very much about the variables concerned: any system, whether based on intuitive or on experimental grounds, can be taught in a straightforward way. Unless criteria of "good" programmes are accepted and compounded into such a system, there remains only a very tenuous body of knowledge with which to indoctrinate a would-be programmer.

Evans, Homme and Glaser (1962b) do in fact produce some evidence in support of their Ruleg system, in that they found a programme constructed by their methods effected equal learning in less time than was required by a programme prepared on less formal lines. This result is, however, vitiated by the shortness of the programmes (*circa* 170 frames and 2 hours) and by the non-Ruleg programme having rather more frames.

A more telling argument in favour of formal systems would arise if authors could show that programmes based on their system could be *written* in less time than by other means. Considerations of student-time are important, but the perennial shortage of teachers must be an overshadowing consideration. If teachers can be given a system of programme construction which significantly alleviates this arduous task, then real progress will have been achieved.

The most noticeable feature of "programming guides" is the author's preoccupation with the concept of the *frame*. Students are exhorted to construct their frames "correctly", shuffle them around into the best order, and thus it is presupposed that the optimum programme will emerge. Let us contrast such a procedure with that adopted in the writing of literature. A programme, like a novel or a play, or a speech, etc., is basically a vehicle for communication. It seems likely that there will be certain common elements in successful versions of all these media, and the new art of programming may have much to learn from more established communication systems.

One of the better instruments for learning so far devised is a good novel. A novel can be regarded as a teaching programme, the terminal behaviour being knowledge of plot, of names, occupations, personalities, motives of the protagonists, of geographical location, etc. etc. Novels seem to work well as teaching "programmes" and possibly research into this medium could forward our knowledge of the learning processes.

Now most works of literature are sub-divided into paragraphs and these are closely analagous to the frames encountered in programmed learning. Although no overt responses are called for, there is a steady demand on the reader to recall earlier material. In fact covert responding takes place continually. At no stage does the author omit essential material and he frequently reviews past material, though generally in a fresh way. At all stages in most novels the reader is aware of the relevance of what he is currently reading to the work as a whole.

Sufficient has perhaps been said to establish an analogy between a

good novel and a successful programme. Now no-one seriously suggests that novels be written as a string of paragraphs and subsequently shuffled around to find an optimum order. Nor do we usually study literature by carving the work up into paragraphs and examining each one to see if it is constructed on "sound" lines. On the contrary, a novel is considered to be far more than the sum of its paragraphs and the present contention is that a programme is, or should be, far more than the sum of its individual frames.

It is probable that the use of frames arose primarily because of the necessity for conformation to a teaching machine format, although even in a machine such a procedure does not seem inevitable.

It may be argued that in the usual type of linear programme a frame is a useful delineation of a snippet of information with its attendant response requirement. This may be so, but a number of unwanted factors may follow on this breaking-down of the material. Pressey (1963) concludes that the Skinnerian approach may destroy the structure of a topic and prevent the correct integration of the subject matter. On a practical level, division into frames may reduce speed of learning, especially with more able students. It is likely that programmed learning, like any other new art or science, will have incorporated a number of unnecessary shibboleths in its initial development, and it may well be that the "frame" is one of these. A notable result is that of Pressey (1964) where part of the classic programme of Holland and Skinner (1961) was in effect "de-programmed" and the resulting condensation showed a clear advantage over the original.

The practical advantage of the "frame" whereby it is a convenient unit in which to elicit a response rests to a large degree on the case for the response to be overt. If one merely "thinks" the missing word(s) as the programme is worked, then it would appear unnecessary to break the material down into such formal units. A good deal of work has been done comparing overt and covert responding. Evans, Glaser and Homme (1962b) found the covert mode provided equal learning in less time and this result is replicated by Goldbeck and Campbell (1962). The latter study also investigated a "reading" mode (i.e. the responses already filled in) which was found superior to both other modes. On the other hand, Krumboltz and Weisman (1962), again comparing Overt, Covert and Reading modes found the Overt mode superior for delayed retention, although there were no significant differences on the immediate post-test.

The literature contains a number of other studies on this topic, the overall impression gained being that there is little to choose between Overt and other modes in amount learned. However, if written responses are in fact redundant, the faster work made possible by other modes does produce a higher learning efficiency.

Wohlwill (1962) has drawn attention to a serious defect in programmes in that they give no practice in self-expression. Branching programmes in general require no more than the writing down of a single letter corresponding to the choices (a), (b), (c), etc., whilst in the usual linear type with constructed responses the most called for rarely exceeds a few words. Fry (1963, pp. 152-3) mentions the possibility of calling for longer responses and mentions a procedure using a "giant step" at the end of a lesson, in which the student might be required to write several paragraphs. A following outline would indicate the main points that should have been covered in the response. The prime intention here was to give a more integrated view of the lesson but presumably such practice in self-expression is advantageous for its own sake.

On the assumption that the overt response is not essential, it may be well worth investigating other modes in combination with occasional opportunities for individual expression. By using the covert or reading modes, there is a reduction in time spent on the programme, and this time could be utilised in at least two ways: the writing of periodic essay-type answers or the building up of a continuous set of notes. Each of these alternatives is a valuable exercise for any student, and there is no reason why the programme itself should not guide the construction of such notes or answers and foster a critical faculty for viewing them.

3. RELEVANCE OF LEARNING THEORY

It is indisputable that the modern surge of programming activity has occurred as a direct result of Skinner's work in the psychological laboratory. Skinner (1954) reviews his work with pigeons and extrapolates the results to classroom teaching, he then goes on to call for a sweeping revision of educational practices. Although Skinner is antedated by a small number of workers, notably Pressey, the efforts of these pioneers had gone largely unheeded.

However, it is by no means generally accepted that programmed learning is underpinned by behaviourist theories. Pressey (1964) has launched a vigorous attack on the theories of so-called orthodox programmers. He maintains that the psychologists responsible for

the theories know little of educational psychology, and are mistaken in assuming that human learning of meaningful material is a similar process to animal or rote learning. Cartier (1963) cites a number of important differences between the behaviour of animals and humans and concludes that behavioural psychologists have blinded themselves to unpalatable facts.

If these criticisms are justified, then any successes enjoyed by programming methods must arise from factors not so far explicitly determined. Nor is there much point in turning to the traditional learning principles of psychology. Gagné (1962) found these principles of little use in drawing up a training programme and suggests that factors such as *sequencing* and *task analysis* are more important than reinforcement, response familiarity, etc. Hill (1963) reviews opinions of a number of psychologists, including both Gagné and Skinner, on the topic of the applicability of learning theory to education. The overall impression is one inclined towards pessimism with a tendency to regard task variables as being more amenable to theory than method variables.

If then programmed learning is to some extent based on false premises and furthermore does not readily submit to analysis or synthesis, where does this leave us in the search for better programming methods? What techniques of training should be employed in order to produce better programmers? The answer to these queries may perhaps be found by viewing programming as just one aspect of the art of writing. In this case, the most necessary requirement for programmers is the same as that for journalists, authors, playwrights, etc., the ability to express themselves clearly and simply in good English. Obviously one stage in training should be the study of a wide selection of programmes of proven worth. One would expect that teachers of programming, like teachers of English literature, can develop generalised techniques of criticism by which programmes can be appraised as such, rather than as a long string of frames.

4. SUBJECT BEHAVIOUR

An important, and neglected, field of research is the establishment of differences between good and bad programmes, and between programmes and teachers, from the point of view of *subject behaviour*. Instead of posing the question, "What are the differences between good programme A and bad programme B?", we should perhaps be asking, "What characterises the behaviour of subjects using pro-

gramme A and how does this differ from the behaviour of subjects using programme B?"

Whereas it is a comparatively easy task to examine inanimate objects such as programmes, or the record sheets of students' responses, in some detail, it is a very different matter to examine subject behaviour. In the extremely limited context of what the student writes down, most programmers study behaviour, but this is only the end-product of a complex mental process. Any deductions based on written responses can only be a very rough guide to the quality of overall behaviour which has gone into the production of such responses.

A first step here, even so not an easy one, would be to closely observe subjects receiving instructions in various ways and to attempt an analysis of how their time is spent. It is clearly difficult to distinguish between the student gazing aimlessly into space and the same engaged in useful thought, but it would be extremely valuable to have some guide to the efficiency of instruction in terms of utilisation of time. An interesting proposal of Goldbeck and Briggs (1962) is the study of eye movement and sub-vocal throat activity, to educe temporal and other factors in responding.

The time taken to produce a response to a given frame is clearly an important factor, and measurement of this latency would seem to be a useful guide in the revision of programmes, but because of obvious practical difficulties such a procedure does not normally form part of programme evaluation. Latency must in any event be a crude parameter as it fails to distinguish between useful and wasted time, but there is probably a case for using a machine in validation which does possess a latency-recording device.

The temporal aspect of programmed instruction would indeed seem a cardinal feature by any standards, and there is a great need for further research. The question of *pacing* is an important one, and one that is susceptible to experimental investigation.

5. SELF-PACING

One advantage claimed with good reason for programmed instruction is that students can work at their own pace. The implication is that in conventional instruction students are forced into working at a common pace. Unfortunately this obscures a truth perhaps as pertinent to the success of programmed instruction as any other single attribute: for much of a course of conventional instruction some students *do no useful work at all*. The pace is too

fast for them and their behaviour completely ceases to be directed towards the course goal.

Now a programme, like any other instructional method, can be geared to bright students or to dull students or anywhere in between. However, the usual process of validation tends to produce a result suitable for the dullest member of the intended population, whereas few teachers conduct their lessons at a level suitable for the least able.

Let us consider two intrinsic variables in a course of instruction:

- (i) D , the difficulty of the course as arranged (*not* the inherent difficulty of the material).
- (ii) P , the pace at which the course is presented.

Then other factors apart, the overall *intensity* of the course will be $f(D, P)$.

In a course of conventional instruction, both D and P are fixed and so $f(D, P)$ will have a fixed value giving a sharp cut-off of student ability below which the course will be unsuccessful. On the other hand, in programmed instruction, P in theory can take any value and $f(D, P)$ will have a range of values according to the value of P adopted by a student. There will still be a minimum value of intensity but by varying his pace to his needs a student can attempt to bring the course intensity down to a value he can cope with.

An ideal adaptive teaching machine will presumably work in the opposite mode: at every stage of learning it will optimise $f(D, P)$ so as to produce the greatest efficiency. This it will do by variation of both D and P according to its growing store of information about the student. Such a process is similar in some respects to that reported by Lewis (1963) who describes various aspects of adaptive machines.

It should be noted that even when working a programme there are hidden agents at work which tend to encourage a student to proceed at a faster pace than may be appropriate. For example, various rewards may attend completion of certain stages—an experiment to be performed, a visit to the library, or even time off before the next lesson. Any factor of this nature may result in a student setting himself a higher pace and thus increasing the intensity of the course.

6. FORCED PACING

There is at present a tendency in some quarters for the wheel to be turned full circle: the student is forced to work at either a fixed pace or within a certain minimum pace.

A typical study is that of Feldhusen and Burt (1962), who found

no significant differences between nine methods of presentation, one of these requiring students to go at a fixed pace, the rate being an average obtained from a previous trial. Other workers report similar findings but these seem to be frequently based on short trials often with easy material.

Should forced pacing become widespread, it will be extremely difficult to differentiate between programmed learning and a well-planned conventional lesson. It is however too early to fully accept the case for this method of presentation: much more investigation is needed.

Much of the pressure for a common rate of working arises out of the growing use of film and television, where it is manifestly impossible to present a *conventional* programmed learning sequence and at the same time allow self-pacing. However, there is another non-practical justification for some restrictions on minimum speed: a student may well not be the best judge of his own optimum speed. Although a forced pace may mean the intensity becoming too great for some, in a practical school situation there is bound to be some measure of forcing. Where the line is to be drawn is nonetheless a question needing a careful answer.

In any event, it is perhaps possible to use ETV, film, etc. without necessarily setting too rigid a pace: different techniques will need to be devised but the possibility of their existence must not be denied on conjectural grounds. For example, by a suitable combination of ETV and work-book it may be feasible to allow a bright pupil to "withdraw" intermittently from the screen for further reading or practice.

7. GROUP PACING

Although there seems at present to be small theoretical justification for forced pacing, some interesting work has been done with the use of programmed learning for groups of students. The distinction here lies in the presence or otherwise of interplay between the individuals forming the group: it is hypothesised that in the usual programmed situation valuable sociological factors are ignored.

Blue (1958) studied the achievement of students who worked alone compared with those working in an organised group. The group study method resulted in higher grades for most students and it is suggested that only the very able would fail to profit by group study. This experiment was not concerned with programmed learning but is an indication that the solitary nature of programmed

work may not be ideal. An interesting result is reported by Dick (1963) working with a programme of great length (3,500 frames). In the study individuals were compared with pairs, the pairs working at a common rate and discussing any frame which gave difficulty to either partner. No differences between modes were revealed on post-testing but one year later the paired group showed significantly better retention.

Even when sociological factors are minimised, there are obvious practical advantages to group working. For example, the programme can be presented by just one strip-projector rather than by a multiplicity of machines or texts. Frye (1963) has investigated this method from the point of view of speed of learning. In his study the programme could only advance when all students had responded, and the variable considered was the time needed to reach a criterion performance. On the basis of IQ and predicted ability, students were allocated to homogeneous groups, heterogeneous groups, or to individual pacing. It was found that students working in homogeneous groups did not differ significantly from those working individually, in time required to fulfil the criterion.

The group situation appears to offer considerable advantages for programming methods and a number of workers are currently investigating this field. Their results are awaited with interest.

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THE NATURE AND PRACTICE OF "HISTORY OF EDUCATIONAL THOUGHT"

by J. L. HARRISON
Lecturer in Education, University of Manchester

I

IN this paper I intend to characterise the nature of the subject known as *History of Educational Thought* (1). I shall begin by arguing that as a species of the history of ideas its primary focus must be historical, and go on to enumerate its six main divisions. This will be followed by a discussion of what HET is not, and is not able to do, which leads naturally to one of the thorniest problems: the extent to which the student of HET may by definition indulge in philosophising. My conclusion is that on the whole he ought not to operate as a philosopher, although he is constantly being challenged by his subject to do so. The paper ends by summarising the chief uses of HET, and suggests criteria by means of which its content can be determined.

II

"History of Educational Thought" is a branch of the history of ideas. Its subject matter comprises in the main a chronological examination of the systems of thought of major educational theorists, generally confined (for us in Europe) to those of Western Europe and America. A major educational theorist may be defined as a thinker who over a considerable period of time has been publicly recognised as offering an inclusive and unified system of ideas relating to all or most of the main issues of education. These issues are: aims and values in general, and more particularly conceptions about curriculum, teaching method, the nature of the child, learning process, culture, subject, the rôle of the school in society, and social history where it is pressingly relevant to the thinking under survey. In attempting to delimit the field of HET the two main problems are those concerning the functioning within it of history and philo-

sophy. I shall be dealing with both these difficulties, and will only say here that Professor Blyth's otherwise illuminating paper on the subject (2) neglects the question of the relations of HET and philosophy, although without considering them the nature of HET can hardly be ascertained.

Before going on to speak of the historical aspect of the discipline, I want to enumerate the main divisions of the subject:

(i) the notation of the main ideas of educational theorists which pertain to education;

(ii) the abstractive summary of these ideas;

(iii) the chronological relations of these systems of thought either as systems or in particulars, where this relation is influential or where to note it is otherwise illuminating;

(iv) the force that socio-cultural events and climate of opinion (and rarely, relevant biographical data) have exerted on the genesis and growth of the ideas;

(v) the relation, not chronological necessarily, of these ideas to other ideas both forward and backward in time;

(vi) the application of these ideas in educational practice where that has been a notable feature.

What it is tempting to add to these six divisions of the subject are a philosophical analysis of argument and system, and, less frequently, study of the relation of the ideas of an educational thinker to the philosophical systems of other men. I shall be arguing in a moment that given our definition and its division these latter two preoccupations are invalid.

Let me illustrate the functioning of these six divisions with reference to Herbert Spencer. The approach of the lecturer (or student) might initially be one of merely summarising the given—let us say, Spencer's five leading kinds of activity, among other things. To save time we will suppose that (i) and (ii) are hereby done, although if they were to be done merely without comment the terms of the discipline would not be satisfied, since we want both an abstractive summary unified in terms of the particular theorist's own value-criteria, and a sense of the *system* of his thought, to come through, at least in that it must be seen to inform the particular notions being discussed. We would then expect some account of the general social pressures in nineteenth century England which conditioned Spencer's thinking: this is division (iv) (I shall come to (iii) in a moment). Darwin, the technological revolution, the Factory Acts, the sense of inadequate education for the middle classes, the pressures towards and away

from a national education system, the pressures exerted by the bulk of Nonconformists, the querying of the value of a classical education: these are of the type of thing that influenced Spencer's thinking about education. And perhaps Spencer is a case in point to argue that biographical data are sometimes relevant enough—his own unusual education and his inventor's talent, for example. Others would argue convincingly that Spencer's "naturalistic philosophy of culture" should be criticised from the standpoint of Cassirer's philosophy of symbolic forms, since to do this would be an economical way of showing how vitiated were certain aspects of nineteenth century positivism. I would agree that this could be valuable, and viable as HET; but it would have to be done simply and most economically. The difficulty here would be, of course, the epistemological question.

We have by now impinged on division (v), i.e. the relation, not chronological necessarily, of Spencer's ideas to those of other educational theorists. The relation looked at need not always, of course, be that indicating a general sympathetic influence; striking contrasts might well be pointed out. We can draw attention to the influence on Spencer of Rousseau and Pestalozzi, and the parallels between certain of his notions and those of Comenius, Vives and Bacon. We might look forward to Thomas Huxley, to the work of the Science Masters Association, even to Bantock and Ashby. In considering Spencer's scheme of priorities of knowledge it would be useful to contrast it with Plato's unitary theory of knowledge (this can just barely be done intelligibly, I believe, without reference to ontology proper), and to refer to the advocacy by La Chalotais of science in the curriculum.

This will bring us on to (vi), the reference to a theorist's impact upon current or subsequent educational practice, or to the fact that a practice of the kind that he might have favoured has eventually followed without apparent direct obligation to his ideas. In Spencer's case one might refer to the increasing admission of science and technology into schools and universities, to the Bryce Commission, even to Crowther's concern for "alternative load", to Spencer's final essay on the teaching of health and hygiene and the care of children, and to the latest statistics on the inadequacy of science staff and equipment in secondary modern schools. But one must guard against the temptation to get drawn into what is properly the matter of a study of a country's educational system: the main attention in HET must always be to the genesis and relation of ideas in time, whether in a few or many areas of content.

So far I suspect there will be general agreement with respect to my main points, it being perhaps unnecessary to add that by no means all of our major thinkers can profitably be studied in the light of all six aspects. In most instances it will be easy enough to decide which approach(es) will be most rewarding. One would not want to deal with the socio-cultural influences on the thought of successive Renaissance educational theorists: that would entail meaningless repetition. And one would be being too meticulous were one to attempt to trace the influence of Bacon's thought in seventeenth and eighteenth century schools, or the influence of Augustine's *De magistro* on Aquinas's *De natura verbi intellectus*.

So far, perhaps, agreement: but it is with the extent to which philosophising is to be part of the discipline, and about the precise rôle of HET as history, that there is disagreement and even consternation. Point (iii) recognises that HET functions as history, and that it is therefore to a large extent concerned with facts and the relations of facts in time, even if in this case those facts are the ideas of men about the meaning and practice of education. HET is not merely a study of the systematic thought of thinkers of some merit about education; it is the history of that thought. Normally when we speak of the history of a thing, e.g. of transport, of constitutions, of a period of time, we mean a complex of events and developments that characterise the nature of that thing viewed temporally, and the interrelationships of those events and developments over a given period of time, particularly cause-effect relationships.

So it is with the history of ideas of any kind (3): it is a record of successive ideas about a certain matter—progress, sexual morality, a classical education. This record must be one of the interrelationships of these ideas, of their genesis and growth and subsidence, with a view to determining the nature of such ideas at a given time, and their alteration through time. HET, then, is a study of systems of educational thought (4), both as systems and as influencing in part or whole other systems, and as reflecting in their genesis and modification socio-cultural forces. (They also sometimes directly effect practical social change; one has only to think of Dewey and Froebel.)

The discipline involved is one of acquiring the facts (or ideas) and of seeing them as interdependently systematised; it is this which comprises knowledge of past theorising about education. But here we run into a difficulty that bestrides the two areas of history and philosophy. In the process of acquiring the facts—they are nearly always concepts and their interconnexions—it is obvious that diffi-

culties will frequently arise in our delineation of the components that go to make up the facts. For this delineation depends on the discovery of what was actually done (or thought), and records of this are incomplete, or the discourse is not clear, particularly where the "fact" is such a shifting and contextually dependent datum as an idea. And this difficulty carries over into the structuring of what we have discovered in such a way that the data can assume the title of fact.

These are familiar problems to historians and to philosophers, but are not always considered to be problems in the field of HET. Yet the discipline must exact intelligent dedication in the search for its nature. In a sense it is true to say that students in any discipline are most properly engaged in it when their activities, researches, reflections require for their completion answers that involve questions as to the essential nature of the subject. Another way of putting this is to say that research and thinking in a field can only be held to be fundamental when by their nature they challenge the hitherto accepted definition of the subject. I am not suggesting that definitions of subjects cannot be stable; for the most part they are stable. But fundamental thinking challenges definition of subject, settling in the end in most instances for constructs and laws and formulations which while stretching the subject area in certain directions as far as possible, are nevertheless themselves determined in their effectiveness by the nature of the subject within which the original questions were meaningful.

So that to return to the main line of argument, there is an initial difficulty with the components whether they are elementary or complex, e.g. Arnold's conception of religion as an aspect of culture, or (what is important in the history of thinking about education through drama) Aristotle's notion of catharsis. The problem is to discern just what the components are in a given writer, and, beyond or before that, to discover how he arrived at them, by what processes of thought. These are the real elements of difficulty, and appear often enough to force us into philosophical activity.

But I want to postpone consideration of this problem for a moment, and will conclude here with the consequences of my definition of HET. For it appears to preclude a number of things from HET, among them the main ones following:

1. It precludes the study of that part of the entire system of thought of a thinker which is not directly relevant to his educational ideas. The parts to be included and excluded can be a matter for dis-

- agreement, but in principle it must be left to the consensus of informed opinion as to what constitutes the proper umbra and penumbra of the educational ideas.
2. It precludes the study of a thinker's life. Biographical data sometimes throw great light on the evolution of ideas, e.g. Plato's early interest in political office, Dewey's work in Chicago at the laboratory school, Herbart's visit to Pestalozzi, Erasmus's stay with More. But life histories as such are irrelevant.
 3. It precludes the study of practical education except when used illustratively or to indicate a determining influence on this or that person's thought. Theoretical education is analytical, systematising and prescriptive, and there is no necessary logical bridge between it and practical education, which is a matter of fact and inconsistent at all levels.
 4. It precludes the study of social and cultural history in general, although particular forces will be indicated to the extent that they are thought likely to have influenced a theorist's ideas.
 5. By and large it precludes the study of occasional, unsystematised thoughts on education, such as Aldous Huxley's or Napoleon's or those of Mme de Genlis and Charles Hoole. Napoleon considerably affected educational practice for a short time, and possibly through the polytechnic may be said to have exercised a durable influence. But his thinking on education is insignificant. (Huxley's thoughts on education in *Island* might be thought to be significant, on the other hand; but there is always the question of priorities given the time.)
 6. It precludes the study of educational sociology and educational psychology as such. On the whole we are obliged to keep our eye on successive *systems* of thought relating to education. We cannot do this if we are continually abstracting psychological or sociological components and forming them into a system, for this would in any event be a system the form of which was dictated by a different content and by different configurations of thinking.

A system of educational thought finds its centre in the unity imposed on all the aspects of education considered by a thinker, and the study of such systems precludes the losing of itself in the tangent of a particular sort of data, whether psychological or sociological or historical.

Nevertheless we are not obliged to preclude the historical survey over years, decades or even centuries of particular ideas. The fate of particular ideas is the business of the history of ideas, under

which HET is subsumed. The notion of "play" in Plato, Aquinas, Froebel, Montessori, Dewey, or that of *Anschauung* in the thinking of Pestalozzi, Herbart and Spencer are ideas the close consideration of which entails, in order that they be understood and clearly presented, reference to the systems of thought about education of their proponents. Nor can we logically proscribe a study of (say) "interest" or "discipline" or "education for leadership" as these conceptions appear in various systems of educational theory, in so far as the conceptions are studied as intrinsic to *systems* of thought about education. Again, of course, such forays will be limited by the priority we give to the study of these systems as a whole.

7. Finally, HET is not philosophy of education. This is so by definition, even if everywhere in the former we are urged to the brink of philosophising about education in order to understand what has been said by this thinker or that. What part of the discipline of HET is it, then, to examine the philosophical grounds of a system of educational thought, or to study the relation of a thinker's ideas on education to philosophical systems? To answer this I proceed to my third section.

III

It is true to say that the student of HET is brought directly into contact with philosophy, or philosophising, at the four points of (i) a logical study of ideas and their relations, (ii) a study of the meaning of specific concepts, (iii) a theory of knowledge, and (iv) axiology, or the science of values. Yet given our six main elements of HET we can see that philosophising of the order just contemplated is out of the question. And if sustained philosophical thinking is not feasible, then little more than occasional, initiating philosophical probings are possible. Some such probings are, however, necessary, even if for the most part they can most fruitfully take place when the educational theorist has some stature as a philosopher, and when his philosophy can fairly easily be seen to have direct bearing on his educational ideas, e.g. Plato or J. S. Mill or Dewey.

Nevertheless, there are other occasions—indeed, very many of them—when we are strongly drawn to the activity of philosophising simply in order to understand what is being said. When, for example, we read statements in Arnold's *Culture and Anarchy* that suggest some sort of intimate relation between culture and religion, we are bound to come at least to the edge of philosophy in order to try to understand what is being talked about. We may not succeed—

I believe it is impossible to succeed in this instance, such is the confusion—but we must try (5).

Presumably we study HET so that among other things we can put our thinking in order about concepts that are held by many to be central to education, concepts such as "culture". Then, in order to decide what sense Arnold's propositions about culture make, we will want to see whether or not it includes the religious act of faith and worship, and if so, how. In the course of examining our own senses of the words while we read through Arnold, we come across statements like the following:

Only, whereas the passion for doing good is apt to be overhasty in determining what reason and the will of God say, because its turn is for acting rather than thinking, and it wants to be beginning to act; and whereas it is apt to take its own conceptions, which proceed from its own development and share in all the imperfections and immaturities of this, for a basis of action; what distinguishes culture is, that it is possessed by the scientific notions of reason and the will of God, and does not readily suffer its own crude conceptions to substitute themselves for them.

Apart from the atrocious legalistic-type jargon of the passage, and the interminable periodic violence it does to our ear, we will find it logically baffling. It is stated that passion by its conceptions can determine what reason says, and what God wills. This is nonsensical. What are we to make here or elsewhere in the book of the notion of the will of God, upon which we are given no guidance, or of the imputing of conceptions to passion? Further, whatever passion's "turn" might be, how precisely can conceptions be said to originate in the *development* of passion? We are later told that *culture demands notions of reason*, whatever that might mean; and following that, that culture will not allow its own notions to substitute for those of reason, although the idea that culture might be said to acquire notions without the agency of reason is senseless.

What is initially lacking here is a worthy conception of the clarity of conceptualising necessary in reasoning, and of the logical relating of clear and distinct ideas; for only by these means can a system of meaning be erected. In any event, we have precisely this obligation to our students and ourselves: to make it clear. If we are to claim that we are expositing systems of educational thought, we must logically exposit intelligible ideas and relations. And if students are to understand what they are told and what they read, they are involved in the same process for themselves. Therefore the student of HET

is of necessity involved in some degree of philosophising, although as stated other claims take priority, for one reason not before mentioned because in order to think rewardingly in a given field we must have come into contact with a goodly number of other minds thinking in that field.

As for the relating of an educational thinker's ideas or system of ideas to philosophical systems other than his own, this is clearly the job of the student of philosophy proper. To comprehend the whole philosophy of any one philosopher is in any event a labour only justified in rare instances. What of this kind is chiefly profitable is the comprehension of specific positions and intellectual stances of a given philosopher on this or that question. We can profit by relating Plato's conception of the Forms, his theory of knowledge, his psychology, to what he has to say more specifically about education—curriculum, for example; we can relate Herbart's idea of knowledge and his psychology of apperception and the subconscious to his educational notion of the circle of thought; but to relate Herbart's epistemology or ethics to Plato's is not the business of HET, any more than it is its job to study Kant's *Groundwork* even though his thoughts on education (not too notable as it happens) depend heavily from the reasoning displayed in that short but historic work.

We are faced, then, with the main job of clearly viewing systems of thought about education, and only from time to time dipping into philosophical waters, either when the terms and logic used are careless, or when underlying philosophical notions are particularly apt and illuminating. Each lecturer must adapt the course to suit his special abilities and interests (within reason). For example, he may be deeply moved by Froebel's thunderclap illumination of the nature and force of play, and yet be unable to stomach Froebel's prose and to communicate Froebel's reasoning effectively. This would be a case for doing as few of the six main divisions of the subject as would provide a fair introduction to him. What cannot be baulked, I believe, is real engagement with the ideas of successive thinkers as ideas, as dynamic and organic elements of thinking that built memorable systems of thought.

In this way HET encourages students to construct criteria by means of which systems of educational thought may be compared and assessed. It encourages critical thinking and the erection of concepts that may in some cases be as firm as, if not firmer than, those read about. It leads to awareness of the fact that all systems of thought incorporate models and analogies that are no more than the con-

structs of individual thinkers; and its subject matter provides continuous evidence that without such constructs effective thinking is impossible.

In addition, then, to the educative joy of discovering a sense of history where systems of educational thought are concerned (hitherto a sense of history has been experienced by most of our students as one of events only), we are led to the judgment of the terms and models of thinking, and even to the threshold of philosophical thinking, i.e. that of examining the meaning of meanings in education. Students of HET are then less likely, as a result of their studies, to fall into the error of which Bain accused John Stuart Mill (noted by F. A. Cavenagh (6)), that of erecting our own deductive system without checking it against principles and laws reached inductively from the study of particular concrete instances. In the case of HET, systems of thought and their particular concepts are our concrete instances.

Finally, what criteria are we to use in order to decide which educational theorists are worthy of our attention in a course limited to twenty or forty hours? I suggest the following five: (i) the quality and depth of the thinking; (ii) the scope of the thinking; (iii) the interdependence of the main elements of the thinking; (iv) the use to which the system of thought can be put in illuminating other systems of educational thought; and (v) the use it has as a discipline of mind which leads to the identification and solution of the basic problems in education at any time, including our own.

We choose Plato because his thinking is masterful in the care with which he conceptualises and otherwise reasons, and particularly in his preoccupation to discover the common grounds in which all his thinking about education is rooted (i); because in his writings on education he treats of all the main issues (ii); because whatever he has to say about a single aspect of education is reasonably (although perhaps not always carrying full conviction) synchronised with all his other explorations of and pronouncements on education (iii); because to have assimilated Plato's thought on education is to have a source of illumination for all other systems of educational thought (iv); and because in order to assimilate Plato's thought one is necessarily involved in acquiring intellectual techniques—or at the worst in studying their operation from a distance—without which thinking about education is likely to be relatively ineffectual (v).

Where these five criteria cannot be satisfied we will choose our theorists in general where several of the criteria are satisfied. Having

thus ensured that the student is being given the opportunity to get as much as possible out of the course, we may then elect (if we have time) one or more theorists whose thought on some aspect of education is particularly striking, e.g. Buber, Kirkpatrick, Owen, Aeneas Sylvius, Sadler, Mannheim, John of Salisbury, Whitehead, Rosmini, Eliot, and the like. These or other names will not be chosen, however, in order to "fill in" a half century or a decade that seems to be otherwise undistinguished by educational theorists. HET is not by nature dedicated to peopling the terrain, but only to noting the eminences where they occur.

REFERENCES

1. Hereafter referred to as HET.
2. W. A. L. Blyth, "The History of Educational Thought: Its Status and Value", *Educational Review*, vol. 14, 1961-2, pp. 171-85.
3. I am taking it for granted that there is general agreement that history is a primary area of knowledge. If this is allowed, it follows that HET is a primary educational discipline. Whether or not it is included, as option or requirement, in a course of educational study at whatever level will depend upon many important secondary considerations. Many would argue that where time will allow only one of HET or philosophy of education, the latter ought to take precedence. I would agree. Where there is time for both, the former is found to be a useful complement to the latter—more useful than the history of practical education.
4. Or of certain ideas only, yet always viewed as derivative from particular systems. The point is taken up later, pp. 151-3.
5. I have in mind such logical and conceptual muddles as that running through the paragraph starting on p. 47 and continuing for three further paragraphs in J. Dover Wilson's edition (C.U.P. 1950). T. S. Eliot has, amongst others, referred in both his "Arnold and Pater" essay and the essay entitled simply "Arnold", to the latter's incapacity for connected reasoning and clarity of concept; and Eliot's animadversions in the former essay on the logical insufficiency of Arnold's exposition of culture are well known.
I am not aware that anyone has suggested that Arnold was a philosopher. But this is not my point. Many writers have heavily criticised his capacity for abstruse reasoning, and quite rightly. We must assume that we were intended to understand *Culture and Anarchy*, yet the argument is in the last analysis impossible either to accept or reject because of insufficiently precise grounding of concepts and criteria.
6. *James and John Stuart Mill on Education* (C.U.P. 1931, p. xii).

BOOK NOTICES

DOROTHY CANFIELD FISHER, *Montessori for Parents* (Robert Bentley, Inc., pp. 238, \$5.95); *The Montessori Manual* (pp. 126, \$5.00).

Montessori for Parents is a popularisation of *The Montessori Method*, reviewed in the February 1965 issue of this journal. Dorothy Canfield Fisher, author of a number of children's books, was so impressed during a visit to Montessori's school in Rome that she wrote this work, in 1912, convinced that an application of methods advocated would transform infant education in America.

There is praise and approval of all she saw and much adulation, to be expected from an enthusiastic convert, for Montessori, but no attempt at anything approaching critical evaluation. This is hardly surprising. Mrs Fisher was not an educationist and the reality of all she saw in Rome made a profound impression. The account is simply written, with great conviction: it is the expression of a missionary extolling an exciting new-found educational gospel and undoubtedly greatly promoted the spread of Montessori's ideas in America.

The Montessori Manual was designed as "a less philosophical presentation of the first book, for mothers unfamiliar with educational practices". It was also hoped that suggestions made would "aid some of the mothers perplexed about the problem of teaching their children the habit of cheerful, sunny self-discipline and self-control".

Photographs familiar to those acquainted with the original publication again make their appearance in both books. Children in a Casa dei Bambini of nearly sixty years ago are seen constructing a tower, word-building and, blindfolded, training the "stereognostic sense", fitting various shapes into recesses.

The master idea of the Montessori system, the reader is told, is the recognition that no human being is educated by anyone else. He must do it himself or it is never done. This position, the antithesis of most teaching in the early part of the century, is dependent on the voluntary action of the child himself. There is, understandably, emphasis on non-intervention by the teacher in the learning process. Margaret McMillan, a contemporary of Montessori, influenced the course of infant teaching in this country to a very considerable extent; unlike the great Italian teacher her work was based on Froebelian methods, which allowed for greater scope of imaginative play and for story-telling and did not rely on self-correcting apparatus. The Froebelian teacher will assist where help is considered necessary: this is an act of understanding and experience. The Montessori-

trained teacher does not directly help the child but this non-intervention may be more apparent than real. Whether using insets, colour spoons or the Movable Alphabet activities are, to a considerable extent, pre-determined and directed by the nature of the apparatus.

As with other books in this series there is much of interest to students of education. Approaches that were in advance of contemporary theory and practice many years ago should be looked at critically: no self-respecting infant teacher to-day, for example, would base child-art on drawing lines round regular shapes.

But there is very much more to be considered than the merits of apparatus. What was common to Frobelian and Montessori teachers alike was a respect for young children, a greatly increased appreciation of their physical and intellectual development, the provision of a secure, happy environment and an emphasis on sound interpersonal relationships between teacher and child.

M. STANTON

JOHN LEEDHAM and DERICK UNWIN, *Programmed Learning in the Schools* (Longmans, 1965, 10s. 6d.).

THIS book is one of the Longmans "Education Today" paperback series. It is a useful introductory text to programmed learning. It covers accurately most of the relevant aspects of the subject and presents the material in a simple manner. The topics dealt with include a general introduction to programmed learning, programmes for the junior school, programmes for the secondary school, a glance at research findings and likely future developments. Some mention is made of teaching machines although the main emphasis is rightly placed on the programmes.

The book suffers to some extent from its dual authorship. The division of labour between programming for secondary schools and programming for junior schools followed by the authors, has led in parts to the fragmenting of the material besides possibly giving the impression that there are different sets of techniques for different areas of programmed learning. In addition the dual approach has led to some repetition so that, for example, there are two chapters on programme writing which cover similar ground and which would probably have done a better job in one more substantial chapter.

The teacher who is completely new to programming will find this book a more useful introductory text than many. It is closely related to the school situation and there are some good examples of programmes although the value of the specimen frames would have been enhanced by more pointed comments on them.

On balance this is a book which can be recommended to the reader making his first acquaintance with programmed learning but it is a pity that it does not mention in its bibliography one of the most useful and authoritative British texts in the field: *A Handbook of Programmed Learning* by Leith, Peel and Curr.

E. STONES

DONALD G. BURNS, *African Education. An Introductory Survey of Education in Commonwealth Countries* (Oxford U.P., 1965).

Dr Burns has written the first text-book for the administration of education in countries which have developed—or are still developing—from British colonial influence towards independent thinking in education. The most fundamental of all problems, that of priorities in education, is stated in the preface and sets the theme for the book, in which he not only discusses all relevant questions in all sectors of education, but also shows the solutions attempted in territories in West, East, Central and South Africa. Dr Burns evaluates the success of such schemes fairly and suggests alternative ways of thinking where for some stated reason or other success has as yet escaped the planners. His reasoning is supported by a wealth of statistical material and quotations from official reports or plans.

The book succeeds in covering the problems which face the administrator and planner in education, in just over 200 pages. Problems are stated and discussed pithily; for instance the all-important question of the medium of instruction in the primary school is dealt with adequately in under two pages. This chapter on Education in the Primary Schools contains, in addition, information based on actual examples on the organisation and length of the course, on primary education “as an autonomous stage”, on aims, pre-primary training, curricula in the lower and upper classes, numbers of enrolment and wastage, promotion, streaming and on maintaining standards. This chapter as indeed every other is followed by a list of references, including reports, official publications and relevant books or articles, which are obviously of considerable value to the reader, even if he is only interested in a more limited territorial aspect of the questions raised.

Other chapters deal with education at the secondary level, further education, the university, the training of teachers, control and direction (that is the administration of the educational system as a whole and in its smaller units within the country) and a summary entitled Present Achievements and Future Needs. All these chapters contain thought-provoking material which is couched in terms easily understood by those whose concern it is to face these problems on the ground, as it were.

It is not possible within the context of this short notice to deal adequately with the wealth of material Dr Burns has so comprehensively used to such good advantage. It may, however, be of some interest to discuss briefly the underlying principle of priorities in education which has been mentioned above. Dr Burns shows that of “the four major areas of development—primary, secondary, higher and adult education” there has been a considerable increase in the emphasis on secondary education and he quotes examples from recent development plans in Ghana, Nigeria, Tanzania and Zambia. It is obvious that developing countries must rely on secondary schools to supply their trained man-power, and that there must be considerable expenditure to make secondary education accessible to a

larger number of deserving pupils, but it is by no means certain whether existing secondary facilities are always fully and efficiently utilised. Experience in West Africa (and India) shows that there is not only a considerable wastage of pupils between the lower and upper classes in many secondary schools, but also that the failure rate amongst those who reach school certificate level (or its equivalent) is frightening. In a fairly recent G.C.E. examination set by the West African Examinations Council, the following percentages of entrants gained full (that is valid) certificates: Nigeria 23%, Ghana 22%, Sierra Leone 9% and Gambia 0. If one looks into the reasons for this dismal success rate one finds that most of the pupils lacked sufficient knowledge of the medium of instruction, that is English in (former British) West African secondary schools, and were therefore unable to answer and, indeed, even to understand the examination questions, and one presumes much of the teaching that went before. If proper attention had been paid to language teaching in the primary schools, the secondary schools would have been better able to do their job to provide young men and women suitable for further or higher training. It is in the primary school that the priority should lie, for there is little to be gained if splendid new secondary schools are built, but the large majority of pupils does not receive that basic training which would qualify them for secondary and higher education.

There is no doubt that Dr Burns has written a most valuable book for teachers and administrators in training and I would strongly recommend it as a text-book for those who are engaged in education in developing Commonwealth countries.

R. H. F. DALTON

RONALD GROSS and JUDITH MURPHY, *The Revolution in the Schools* (Harcourt, Brace and World, N.Y., 1964, pp. vi + 250, \$2.95).

THIS paper-back collection of writings on changes in organisation, curriculum and method in American education communicates some of the vigour which inspires the work of reform. It is divided into three sections: educational technology; organisation of teaching and teacher education; and the impact of new understanding of learning processes on methods and curriculum. Several important and trend setting papers are reprinted, for example Skinner's "The Science of Learning and the Art of Teaching" which put forward the basic ideas of programmed instruction; Bruner's "The Act of Discovery" which is a mainstay of science and mathematics curriculum reform projects; a section of Getzel's and Jackson's book *Creativity and Intelligence* which has provoked much rethinking of the aims and methods of teaching; there is also a description by O. K. Moore of the autotelic responsive environment for learning whose computerised talking typewriter was recently demonstrated over here. Other chapters of interest are those on television teaching (Conant), team teaching, the non-graded school and the design of new schools and new curricula.

This review can only summarise the ideas which inform many of the

individual chapters of the book. The emphasis is on individualising the pupil's learning by creating much more flexible groupings of children than hitherto and by automating instruction in such a way that responsiveness to individual needs is maintained and improved. Changes in the content of the curriculum are designed to eliminate sections which are out of date and give a more integrated structure to the subject matter. Discovery, problem-solving and creativity are the guide posts for educational planners and teachers are given a responsible, creative rôle in the planning. Indeed the job of the teacher in the light of these ideas is made more attractive. The amount of time to be spent on tasks requiring the subtle arts of communication and the skills of diagnosis and special educational treatment is increased while duties involving routines and drills are taken over by machines or ancillary staff.

These ideas are beginning to be implemented in the U.S.A. Our own revolution is gathering momentum. Teachers and students should read *The Revolution in the Schools*. Some will be inflamed but others may be inspired.

G. O. M. LEITH

K. M. EVANS, *Attitudes and Interests in Education* (Routledge and Kegan Paul, London, 1965, pp. viii + 168, 16s.).

DR EVANS has addressed her little book to students and teachers engaged on advanced work in Institutes and Departments of Education as well as to the wider readership of teachers in general. It is intended as an accessible account of methods for the study of attitudes and interests in school children and an introduction to some of the experimental work carried out since 1930.

Following an introductory chapter stressing that attitudes and interests are learned and one reporting studies of the development and alteration of attitudes there is a chapter on methods of assessing attitudes. Later sections are given to the structural organisation of attitudes and attention is focused on attitudes to authority, the self and to other groups. The study of interests following a similar pattern with some details given of a number of methods of measuring interests.

It is probably to the chapter on the preparation of attitude scales that advanced students will most frequently turn—only to return to Edwards'* for examples and guidance on the specific steps to take. Evans outlines the Thurstone equal-appearing intervals and Likert methods of scaling in two pages of the text which includes reference to the statistical measures used. Guttman's scalogram technique (and its modification) gets one page. It should be added that there are four pages exemplifying a combination of the Thurstone and Likert methods.

The book gives the impression that it has been condensed. References

* *Techniques of Attitude Scale Construction* (N.Y.) Appleton, Century, Crofts, 1957. Ch. 9 in Lindsey, G. *A Handbook of Social Psychology*, Vol. I (Cambridge, Mass.) Addison Wesley, 1954.

are given, without explanation, to statistical methods such as "split-half" correction and factor analysis ("positively loaded on instructionalism . . . and negatively on individualism", p. 60; "treatment of the results by inverted factor-analysis follows . . .", p. 70). Teachers acquainted with these concepts are unlikely to need instruction in preparing attitude scales or, if they do, will wish to read Green's elucidation of attitude measurement.*

The experience of this reviewer has been that students need guidance on such things as the number of judges required (in this book 300, 40 by interpreting a table—and, much later, 12 are mentioned), how to obtain a pool of attitude statements, the form of statements and the meaning of cumulative frequency, median, quartile, etc. These instructions are not given. There is no reference, either, to Semantic Differential.

G. O. M. LEITH

* Ch. 9 in Lindsey, etc.

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UNDERSTANDING IN JUNIOR SCIENCE

by J. F. KERR

Professor of Education, Leicester University

and G. NEAL

Senior Lecturer in Education, Dudley College of Education

I. INTRODUCTION

FOR some time the view that science should be included in the junior school curriculum has been advocated (1) but it is only in recent years, mainly through the Junior Science Section of the Nuffield Foundation Science Teaching Project (2), that the scope of the work has been broadened to include more topics from the physical sciences. Although science is a major influence on the lives and environment of children, the characteristic value claimed for this kind of experience in schools arises from the investigational nature of the work. It would seem advisable to look critically at the suitability of science topics in relation to the child's capacity for inferential or deductive thinking before we enlarge an already overcrowded curriculum. For teaching purposes, it would also seem desirable to know the minimum chronological and mental ages necessary for the successful introduction of given topics.

The general problem may be approached in two ways. First, we may consider children's explanations of naturally occurring phenomena and thus gain useful insights into the difficulty levels of items which we may wish to include in a syllabus; and second, we may consider the child's development of causal thinking, particularly that which operates when phenomena are directly presented in a classroom teaching situation. This article* is mainly concerned with the second approach although some research is reviewed which deals with both.

In recent years there have been various inquiries into children's explanations of natural phenomena, most of them stimulated by the earlier work of Piaget (3). In 1937, Deutsche (4) used questionnaires and experiments to find if causal thinking developed in set stages as suggested by Piaget. Deutsche found that no particular type of ex-

* Based on an unpublished M.Ed. thesis: Neal, G. An investigation into the development of scientific concepts in junior school children. Leicester University, 1963.

planation was linked to a given developmental age. In other words, all types of explanations occurred throughout the age range tested (8-16 years), many of them being of the mechanical and logical-deduction types. The scientific adequacy of the explanations given was found to be determined more by tuitional and experimental factors than by intelligence or socio-economic status—an encouraging finding for the teacher seeking to give scientific experience in the junior school. The adequacy of the answers as scientific explanations also increased with age. In 1947, Oakes (5) used the interview method with kindergarten children and in the main confirmed the findings of Deutsche. In 1961, King (6) tested over 1,200 primary school children by means of a schedule containing 70 questions. Children were asked to give their explanations of various phenomena (length, weight, time, direction, volume, living things and the seasons, and certain mechanical principles). For certain questions an increase in correct explanation came with increasing age. In addition, King also noted the importance of mathematical concepts (weight, length, volume) in the children's understanding of scientific phenomena.

In contrast to these investigations in which the questionnaire technique was widely used, Piaget permitted the use of experimental materials in his investigations into logical thinking (3 and 7). By so doing, the child was allowed to use his own form of scientific method (observation, experimentation, hypothesis, confirmation) to solve the set problems, a situation far removed in interest from answering questions on a written sheet. Piaget found that true causality begins to appear about 7-8 years; that explanation by logical deduction comes from 10-11 years onwards; and that length is conserved or understood at 7-8 years, weight at 9-10 years and volume at 11-12 years. These findings have stimulated a great deal of subsequent research (8) designed to verify the work of Piaget and, in addition to the finding that the ages should be considered in terms of mental rather than chronological age, two viewpoints emerge from all this work. First, the probability that primary children are capable of mechanical and factual types of explanation; and second, that deductive or inferential thinking, which depends on experience in many fields, is generally in evidence at the end of the primary stage. Some interesting questions follow from these general conclusions. First, at which chronological and mental ages does deductive or inferential thinking operate in relation to length, weight, time . . . and certain mechanical principles? Second, what degree of this ability do we require in children before we begin to teach them? And third, is it

possible to accelerate the development of inferential or deductive thinking by suitable experiences or methods?

The research reported here is concerned with the first two questions although in view of the present rapid advance in scientific knowledge, the third is probably of greatest importance.

2. METHOD

Experimental demonstrations on the lever, electricity, sound, air and cooling were devised and given to 208 children from a school in an industrial area. The children had not received any previous science teaching. One lesson of 35-45 minutes was given on each topic to nine classes, the chronological age range of which was 8 years 6 months to 11 years 10 months. It was hoped to obtain some indication of the ages at which inferential thinking became evident and consequently, an indication of the optimum time when certain topics should be taught. Each experimental demonstration was designed to investigate three ideas, each of which was presented to the children in two ways. First, the idea (or fact) became apparent as a result of a change of one variable, and second, as a result of a further change, an apparently contradictory event occurred. After each change the children were asked to select the correct response in a multiple-choice test item with six plausible alternatives. Responses were recorded on a duplicated answer sheet. By proceeding in this manner through the series of lessons, a record of each child's ability to respond correctly at each stage of each demonstration was obtained. The production of test items raised difficulties, particularly the expression of scientific explanations and alternatives in language appropriate to the junior school child. Before the main investigation started, questions were tried out on a trial population from a similar area. Using the upper and lower thirds method of item analysis, suitably discriminating test items were selected for use in the study. A brief outline follows of the five sets of experimental demonstrations and the proportion of boys and girls who correctly responded at each stage.

3. EXPERIMENTAL RESULTS

(a) *Balance or Equilibrium*

An experimental demonstration, using a six-foot balance bar and identical jars as weights, was devised to investigate the influence of three factors—weight, distance from the fulcrum, and proportionality—in maintaining equilibrium of the bar (the see-saw principle). The children found the distance factor the easiest, proportion came

second in order of difficulty and weight last. As weight has to be experienced rather than observed it is to be expected that this factor would be of greatest difficulty. An interesting finding in this experiment was the higher scores of the boys. Percentages of correct responses given during the experiments are reproduced below:

TABLE I

	<i>Boys</i>	<i>Girls</i>
Weight	38·0%	33·9%
Proportion	44·8%	35·7%
Distance	52·1%	47·7%

(b) *Electricity*

Investigations with a circuit board resulted in three findings—first, that a conductor is necessary to complete a circuit; second, that a circuit must be completed before a lamp will light; and third, that the brilliance of illumination depends on the type of circuit and the degree of power available. The first factor demanded the categorisation of materials into conductors and non-conductors; the second, inference in an easily-demonstrated cause and effect relationship; and the third, inference in which observable physical movement plays a relatively minor part. This last factor is a far more difficult proposition than the first two—a fact borne out by the figures of correct responses given.

TABLE II

	<i>Boys</i>	<i>Girls</i>
Circuit and available power	38·3%	40·6%
Circuit completion	44·8%	40·2%
Conductor	61·4%	59·9%

It is hard to account for the apparent difficulty of the second factor in which circuit completion was quite clearly demonstrated. It may be that the notion of circuit, which was common to the two most difficult factors, was the major source of difficulty.

(c) *The Nature of Air*

The factors investigated were first, that air is a substance; second, that it has weight; and third, that it exerts pressure. The first factor was shown by the use of a jar into which was inserted a funnel and a tube, the tube being opened and closed by a clip. The existence of air was shown by pouring coloured water into the funnel with the air-escape tube closed. The second factor was shown by weighing an inflated football, forcing the air out and weighing again, and the third

by placing a card over the top of a water-filled tin in which a hole had been punctured.

TABLE III

	Boys	Girls
Air has weight	45.9%	34.8%
Air exerts pressure	49.0%	46.4%
Air has substance	53.1%	48.6%

Again, weight proved to be the most difficult factor although the existence of all three factors has to be shown by their effects.

(d) *The Nature of Sound*

Here, three small experiments were used. The fact that sound is caused by a vibration was deduced by striking a hacksaw blade placed on the edge of a table. Dependence of pitch on length was demonstrated by using a "one-string fiddle". The final factor—the relationship between intensity and amplitude of swing was investigated by plucking a large rubber band which was stretched over a metal sounding box. Amplitude of swing was seen to be related to the degree of force used in plucking the band.

TABLE IV

	Boys	Girls
Intensity depends upon amplitude of swing	35.9%	31.7%
Pitch is dependent upon length	43.7%	36.6%
Sound is caused by a vibrating object	44.3%	39.7%

Again, a sex difference in favour of the boys was evident. Of the five demonstrations this proved to be the most difficult. The inference required demands both visual and auditory discrimination.

(e) *Cooling*

This demonstration was designed to find out three factors—first, that hot water cools when exposed to cooler air; second, that insulation increases the time taken; and third, that the rate of cooling is partly dependent upon the quantity of water involved. These were investigated by comparing the cooling rates of different quantities of water in insulated and uninsulated jars. Readings of temperature were taken by thermometer and recorded on the blackboard.

TABLE V

	Boys	Girls
Cooling rate is partly dependent upon quantity of water	39.1%	34.4%
Insulation conserves heat	42.7%	42.2%
Hot water cools when exposed to cooler air	45.8%	44.6%

4. INCORRECT RESPONSES

Analysis of the frequency with which each of the *incorrect* responses in the multiple-choice questions was selected by the children threw some light on other aspects of children's thinking. Ideas for suitable alternatives were taken from Piaget (3 and 7), Deutsche (4), Oakes (5) and Lovell (9). Although alternative responses based on shape, space, weight, strength and force were generally used, in certain instances adaptation had to be made. The percentages of children who chose each incorrect alternative varied indiscriminately with reference to the concepts of shape, space, weight, strength and force. The whole age range used each incorrect alternative; that is, there was no evidence to suggest that particular alternatives were preferred at certain ages. This finding confirms the work of previous investigators (Deutsche and Oakes).

5. CHRONOLOGICAL AND MENTAL AGE

So far we have been concerned with the nature of experiments and the explanations given to factors within those experiments. For teaching purposes, it has been suggested that we really need to know at which chronological and mental ages a given degree of understanding operates. We may then have a guide for the introduction of topics. In order to answer this question the correct explanations were analysed by a placement technique based on Washburne's work in arithmetic (10). In addition, correlation coefficients were computed between the experimental scores and chronological and mental age in order to find which of these could be assumed to be the better predictor for later science success.

The ascertainment of the order and ages at which science topics may be introduced depends on three things—first, the degree of difficulty of the experiments used; second, the scores on the tests which are taken to indicate either the presence or absence of understanding; and third, the proportion of children whom we expect to attain a given level of understanding.

In this inquiry, the demonstrations were rated in the following order of *increasing* difficulty:

- The nature of air
- Electricity (circuit board)
- Balance (see-saw principle)
- Cooling
- The nature of sound

To estimate the age at which these science topics might be introduced, the test items were analysed for two levels of difficulty—first, when two correct replies was taken as the criterion for “understanding”; and second, when the arbitrary dividing line was taken to be three correct replies.

The proportion of children reaching these levels is important. Few teachers would delay teaching a topic until a certain level of understanding was achieved by *all* children. On the other hand, if less than half the children possess the minimum level of understanding the teaching will be uneconomic in terms of the teacher's effort or the child's success. In this investigation the figure of 75% has been adopted as the proportion of pupils who should score two or three correct responses out of six. In other words, the recommended minimum chronological and mental ages for the introduction of topics (see Table VI) are based on the assumption that either a third (2/6) or a half (3/6) success forms a suitable criterion for introducing work in that topic. The figure of 75% is quite arbitrary and it should be borne in mind that if different figures or criteria are adopted, then the minimum recommended ages will inevitably be affected. The criteria adopted are ultimately a matter for the teacher himself.

TABLE VI

MINIMUM MENTAL AND CHRONOLOGICAL AGES

(a) Criterion—75% or more pupils with $33\frac{1}{3}\%$ success

Mental Age				Chronological Age			
Boys		Girls		Boys		Girls	
Air	7 ⁶	Air	10 ⁰	Air	9 ⁷	Air	9 ¹
Electcy.	9 ³	Electcy.	10 ⁶	Balance	9 ¹⁰	Cooling	10 ³
Balance	10 ³	Cooling	10 ⁹	Electcy.	10 ¹	Balance	10 ⁵
Cooling	11 ³	Balance	11 ⁹	Cooling	10 ¹¹	Electcy.	10 ⁵
Sound	11 ⁶	Sound	12 ⁰	Sound	11 ⁵	Sound	11 ⁴

(b) Criterion—75% or more pupils with 50% success

Mental Age				Chronological Age			
Boys		Girls		Boys		Girls	
Sound	13 ⁰	Electcy.	12 ⁶	Air	9 ⁶	Air	9 ¹
Balance	13 ⁶	Cooling	13 ⁰	Balance	10 ⁰	Electcy.	10 ¹
Electcy.	14 ⁰	Air	14 ⁰	Electcy.	10 ³	Sound	10 ²
Air	14 ⁰	Balance	14 ⁰	Cooling	10 ⁸	Cooling	10 ³
Cooling	14 ⁰	Sound	14 ⁰	Sound	10 ¹¹	Balance	10 ⁵

6. DISCUSSION

Table VI suggests that children with a chronological age below 9 years are likely to have little understanding of the experiments used in the demonstrations. Furthermore, the chronological ages at which we may expect understanding in each of the six topics is independent of the criteria adopted. There is little difference in the minimum chronological ages whether the criterion is $33\frac{1}{3}\%$ success or 50% success.

In the case of mental age a different picture emerges. If we accept the $33\frac{1}{3}\%$ success criterion for 75% of the sample, then for certain demonstrations a minimum mental age of approximately eighty years will suffice. Alternatively, if we demand the higher criterion of 50% success, then possession of a sufficient degree of inferential ability would seem to belong to the highly intelligent children only. (The lowest minimum mental age is 12⁶ years.) It seems that if we are to teach inferential science to juniors, then we must be content with the lower criterion and assume that appropriate experiences and skilful teaching will promote the development of inferential ability. The importance of mental age in science readiness is also stressed by the degree of correlation between the experimental scores and mental age.

TABLE VII

CORRELATION COEFFICIENTS BETWEEN THE EXPERIMENTAL SCORES
AND CHRONOLOGICAL AND MENTAL AGE

	<i>Chronological Age</i>			<i>Mental Age</i>		
	<i>Boys</i>	<i>Girls</i>	<i>Combined</i>	<i>Boys</i>	<i>Girls</i>	<i>Combined</i>
Balance	·14*	·26**	·20**	·39**	·45**	·41**
Electricity	·10 N.S.	·35**	·26**	·44**	·49**	·47**
Air	·09 N.S.	·19*	·14*	·21*	·26**	·23**
Sound	·03 N.S.	·34**	·21**	·52**	·46**	·48**
Cooling	·12 N.S.	·19*	·16*	·44**	·45**	·45**
Pooled	·11 N.S.	·36**	·25**	·52**	·60**	·56**
Significance levels	* = 5% ** = 1%					

The greater degree of correlation between the experimental scores and mental age suggests that mental age may be the better predictor

for science success. Although the *differences* between the coefficients for mental and chronological age were with one exception (air) statistically significant, the coefficients were low and it would seem that other factors also play an important part.

When we consider both chronological and mental age together, then the introduction of the topics used in this study would seem possible during the last two years of the junior school course. They would also seem to demand average or above average intelligence if some degree of reasoning is expected.

In conclusion, it must be stressed that this research has attempted to find the minimum chronological and mental ages necessary for the introduction of certain science topics. The minimum ages indicated by the study must be regarded only as a guide to the time when teaching may be started. The problem of greater importance is whether or not we can lower these ages by suitable experiences and techniques. This is an urgent matter which should depend on prior research rather than on inspired intuitive opinion. In the absence of such knowledge, too early an introduction of topics by methods which echo those suitable for a later stage of development will result in precarious knowledge based on imperfectly understood concepts. (The work of Saad (11) discloses a parallel case in mathematics.) If this occurs then it seems probable that unfavourable attitudes to science will result with the consequent negation of interest in the subject for many of our children.

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A TEST OF LISTENING COMPREHENSION

by ANDREW WILKINSON and DOROTHY ATKINSON

Department of Education, University of Birmingham

I. PREVIOUS RESEARCH

ORACY involves two elements: adequacy in speaking and adequacy in listening. In this country neither have received sufficient attention of the right kind. Oral expression (OE) has too often been left to the "speech and drama" teacher; listening comprehension (LC) has usually been left to nobody at all.

And yet a very large amount of listening goes on in educational situations. Wilt (1950) examined the classroom time spent by 530 elementary school children of all levels and found that they were listening for 57½% of it, a daily average of 2 hours 38 minutes each. College students were found to spend 42% of their time in listening, 25% in speaking, 15% in reading, and 18% in writing (Bird, 1953). Rankin (1929) surveyed the total "communication time" of 68 adults—it proved to be 45% listening, 30% speaking, 16% reading, 9% writing. Doubtless such findings will vary with the groups and institutions concerned. The Reciprocal Speech Situation is finding more favour in teaching with the recognition of the active nature of learning; but this fact has to be weighed against the great increase in the use of the mass media in education which by their nature usually reinstate the Formal Speech Situation. It is clear that we listen far more than we speak and will continue to do so.

In view of the importance of listening and the amount of practice the average person obtains in it, it might be expected that it would be a fairly efficient function. The findings of research however do not support this. Wall (1949) and Vernon (1950) found that listeners retained very little of forces educational talks broadcasts; Belsen (1952) that the average listener took in about 28% of the ideas and information in BBC "Topic for Tonight" talks (university graduates 50%, those who left school at fifteen, 20%). Investigations suggest that college students comprehend on average only half their lectures (Brown, 1950; Nichols, 1949) and possibly less than this (Irvin, 1953).

From observation and research it seems that there is room for considerable improvement in general listening ability.

That ability in listening can be trained is demonstrated by various experiments (Bird, 1953; Brown, 1954; Erickson, 1954; Irvin, 1953; Nichols, 1949; Lewis, 1956). In a study by Hollow (1955) elementary school children were trained in listening by daily twenty-minute lessons over six weeks, each lesson being concerned at first with one, and later with two or more, basic listening skills. A more elaborate training in listening skills was given by Pratt (1956). These skills were: keeping related details in mind; observing a single detail; remembering a series of details; following oral directions; using contextual clues (i.e. the context often gives the meaning even when particular words are unknown); recognising organisational elements: selecting the main ideas, drawing inferences, recognising subordinate ideas that support main ideas. In both studies pupils of all grades of ability were found to have benefited, though other researches suggest that those whose normal listening ability is not good will benefit more by training than those who are of high listening ability to start with. It should be stressed that the methods used here were for the purposes of experiment and are not offered as necessarily a good pattern for ordinary classroom practice.

As would be expected listening comprehension gradually improves throughout the school (Wright, 1957; Hampleman, 1955; Brown and Carlsen, 1953; Caffrey, 1955a), and is better among adults with good educational backgrounds. It has a pretty well established relationship with IQ, usually varying between .4 and .8 (see for example Hollow, 1955; Brown and Carlsen, 1953), and a similar relationship with reading comprehension (e.g. Caffrey, 1955b; Hollow, 1955), on the whole correlation being higher among older children. In an English experiment King (1959) found that boys did better than girls on tests with practical and scientific content, but girls than boys on descriptive and imaginative passages. The weight of the evidence however seems to be that there is in general slight male superiority in listening; and in Caffrey's experiments (1955a) with high-school students this was shown not to be due to sex bias in content.

One of the most interesting aspects of the research has been the attempt to discover what factors are involved in listening comprehension. One worker has examined intelligence, recognition of correct English usage, size of listener's vocabulary, ability to make inferences and to sense the organisation, interest in and attitude towards the

subject, audibility, fatigue of the listener (Nichols, 1948). Biggs examined similar factors, and her work pointed towards a listening factor which was independent of the others (1956). The most important study of listening comprehension is by Spearritt (1962). One of his concerns was to investigate this matter of whether there is a separate listening factor, or whether performance can be accounted for in terms of reasoning, verbal comprehension, attention and memory factors. By factorial analysis he demonstrated the existence of such a factor in the first order domain, most closely associated with performance on verbal comprehension tests, and fairly closely associated with performance on span memory and inductive reasoning tests. He found that on the whole listening comprehension tests did not make more demands on memory than reading comprehension, in so far as rote memory and meaningful memory was concerned, but that they did so on span memory (ability to remember sequences), clearly because one cannot refer back in speech, in the way one can when reading.

Summaries of research are given in Spearritt (1962); Wilkinson (1965); a popular account is to be found in *Children and Oral Language* (NCTE, 1964).

2. PRINCIPLES OF TEST CONSTRUCTION

In 1963 the Ministry of Education (now the Department of Education and Science) commissioned the Birmingham University Education Department to produce an LC test for students of sixteen years old between the 40th and 80th percentile of ability for use in the CSE examinations.

It was felt important that this should be a test of spoken language comprehension in the way that previous tests in America and elsewhere had not been. The Brown-Carsen listening comprehension test (1953) for instance, widely used in USA at college level, consists of items and passages read aloud by the administrator. It is clear that this limits very much the nature of what can be tested; features which only exist in the spoken language—intonation for instance—cannot be used because there is no guarantee that the various administrators will utter them the same way. Further, the Brown-Carsen passages are of a literary nature, and literary material does not communicate with the recipient in the same ways as spoken material, with its empirical structures, reciprocities, stabilisers, etc. In the Birmingham tests it was felt to be important that a listening test should not be of literary material read aloud, but as far as possible of genuine

spoken language recorded as uttered. This does not mean that some of the items might not conceivably occur in a reading comprehension test—speech and writing of course draw on a common stock of language. But even these common items are involving in some sense the ability to listen in the LC test. The question to ask about them is not whether they could occur in a reading comprehension test, but whether they test understanding of something which frequently occurs orally. Thus one often receives verbal directions as well as written; one often meets the advertising register on television as well as in newspaper.

For these reasons it was decided that the whole of the test material should be recorded on tape. The questions were also included on the tape. Answers were of the multiple choice (usually triple) kind and the alternatives were given in an answer booklet, the subject having to mark his choice. The intention was to make the marking completely objective. This was felt to be particularly important in the CSE context where the test was conceived as being complementary to an OE test or tests. The reliability and validity of OE tests cannot be guaranteed; a good deal of work is going ahead on them (Wilkinson, 1965; Hitchman, 1966; Schools Council, 1966) and teachers will need also to define common standards by using such devices as oral composition scales (Birmingham NATE, 1966). Nevertheless there are good reasons why a large amount of subjectivity will remain. A completely objective LC test whose reliability depends on a careful standardisation procedure is thus a most useful criterion device which has the further advantages of being easy to administer, and requiring little time. Strickland (1962) claims that there is a higher relationship between speaking and listening than between speaking and any other variable she has tested, and there is in linguistics an increasing belief in the identity of production and reception. If so the LC results could be used as a point of reference in oracy testing. It is fair to add that she is concerned with elementary school children. The indications in the Birmingham research do not bear this out as far as adolescents are concerned. Nevertheless in view of the importance of listening it is still very useful to have a completely reliable measure.

An early trial test consisted of three sections: content; register and style; and phonology. It was used on a number of occasions with schools in the Midlands and in a CSE trial in the Southern Region. The number of items proved too small to disclose a very reliable or valid result, but a number of valuable things were learnt from the experiment, particularly that the predictions of the test

constructors and groups of practising teachers about the performance on particular items were of little value. On the whole the children's listening abilities were of a much higher order than they were given credit for.

3. THE TRIAL TEST

The sections in the test were as follows: (1) Content, (2) Detail, (3) Transitions, (4) Word Meaning, (5) Ambiguity, Deduction, Intonation, (6) Register, Style. Of these the first two, which consisted of passages of continuous or conversational utterance, were clearly the most important and this was reflected in the loading of the marks. To some extent the other sections were subsumed in them. Only to some extent however, because the occurrence of any one particular speech feature—an irony, an ambiguity, a stylistic usage—is not necessarily frequent in any one piece of utterance, and is seldom courteous enough to occur in close proximity to other such speech features for the convenience of the test constructor. The first two sections therefore are of continuous utterance, the other five are of individual items designed to test understanding of specific features. Atkinson has given a full description of the test with demonstration items elsewhere (Wilkinson, 1966) and thus it will be appropriate here to give an outline only.

(1) *Content*. The listener might be expected to understand the major and minor ideas, to infer as well as to recall, to be aware of the direction of the utterance, of the profession or attitude of the speaker, to interpret figurative language. A passage of narrative is used punctuated by comments and prompts from other speakers. The questions are asked on the tape after the passage has ended; and an appropriate time of a few seconds is given for the answer to be ticked in the answer booklet.

(2) *Detail*. Correct recall of facts is often important particularly in a learning situation. Thus this test is concerned more specifically than (1) with the remembering of particular items. A three minute passage of exposition is played, and the subjects then have four minutes in which to read the questions and tick the correct alternatives.

(3) *Transitions*. The question in effect asked is: Whereabouts in an utterance do you think this sentence occurs—at the beginning, during, or at the end? Thus "A funny thing happened to me on the way to the Forum" is clearly introductory. "For instance there's the case of Ruth Ellis" points both backwards and forwards, and thus

occurs during an utterance. One needs to be able to recognise signals which inform one as to the progress of an utterance, especially if one joins it part way through as frequently happens. A question occurs on the tape after each item.

(4) *Word meanings.* Word meaning is contextual. Subjects are asked to distinguish which meaning of a particular word is intended in a specific context. "I'll give a pound" has at least four meanings leaving out differences which could be brought about by intonation. Two of these meanings (£1 and 1 lb) are likely; a third (pound = animal pen) is quite possible, and so is a fourth in the famous story of the boy who offered his pound (of pulling power) to launch the life boat. A question occurs on tape after each item.

(5) *Verbal ambiguity.* Many common utterances involve a choice of alternatives. They present a problem or series of problems, to be solved before the intended meaning is hit upon. "I'll never not love you", is one example, and the question would ask whether or not he would continue to love her. A question occurs on the tape after each item.

Rapid Deductions. One commonly deduces the subject, person or thing under discussion from contextual clues though it is not actually mentioned. "He made a flying start from the standstill position." Aeroplane or racing car? From the vocabulary (aeroplanes are never described as making a "flying start") clearly the latter. A question occurs on the tape after each item.

Intonation. Under this head are included meanings brought about by changes in tone or emphasis. "Light house-keeping" is not the same as "light-house keeping", nor "What *are* you doing?" as "What *are you* doing?" Questions follow individual items on the tape.

(6) *Register.* Different groups of people, especially occupational groups, have their own vocabulary (and to some extent grammar). Some advertising attempts to appropriate a medical or a poetic vocabulary. Subjects might be asked to distinguish between the appropriate and the appropriated. Questions after each individual passage.

Style. The sense of test relationship between two people in a particular situation is indicated by the language they use. Examples are seen in the use of titles, surnames, Christian names, endearments; but these things are only indications and may easily be absent. "I lay a somewhat different emphasis from Mr Jones" in the board meeting, might be "Your talking nonsense Harry" in the pub, where the whole form of words is different. Subjects are asked to consider appropriate and inappropriate utterances (questions after each item).

4. RESULTS

The battery originally consisted of 100 items in seven sections, the seventh section being the following of instructions. It went through two preliminary tests with boys and girls of the 40th-80th percentile in their CSE year. The first was with 129 pupils in two schools, correlations being obtained with a variety of language measures, and of a listening test of literary material read aloud, and of IQ. A further trial took place with 273 similar subjects in five schools, and again other measures were taken. On each occasion invalid items were replaced. In both trials section seven proved too easy, and it was dropped for the third trial.

This trial was in three schools with 145 boys and girls. Correlations were obtained with IQ, teachers' estimates of oracy, and with performance on written work (three class compositions). The standard deviations indicated that the tests were discriminating well. (In (1) Content—15 items—they were 2.28, 2.71, 2.50.) Correlations with the measures were as follows:

<i>School</i>	<i>IQ</i>	<i>Oracy</i>	<i>Composition</i>
A	.61	.23	.20
B	.76	.40	.48
C	.53	.55	.44

Apart from the two low correlations in school A where there were special difficulties the correlations were very satisfactory, and were fully supported by figures in the previous trials. Too high a correlation would indicate that the test was measuring something already being measured in another way; such as by an IQ test; too low a correlation, especially with linguistic measures, would suggest invalidity. The predictions of the teachers on oracy are necessarily based more on the expressive than the receptive ability of their pupils.

Intercorrelations between the various sectors were calculated:

correlations between the				3	
1		2		3	1.0000
1	1.0000	2	1.0000	4	0.3453
2	0.0596	3	0.1722	5	0.2577
3	0.2244	4	0.2235	6	0.2994
4	-0.0678	5	0.1306	7	0.2214
5	0.2791	6	0.1384		
6	0.2142	7	0.1251		
7	0.0379			6	
4		5		6	1.0000
4	1.0000	5	1.0000	7	0.2598
5	0.2839	6	0.3327		
6	0.3162	7	0.4429	7	
7	0.2665			7	1.000

From these figures it is clear that in this battery no test was seriously duplicating the testing of a particular factor. Tests 1 and 2 (continuous passages) are distinct; both tests 3 and 6 participate to some extent in 4 (word meanings); 5 and 6 also have something in common.

5. SUMMARY AND CONCLUSIONS

1. The project was to construct a listening comprehension (LC) test suitable for sixteen-year-old children of the 40th-80th percentile of ability.
2. Previous LC tests had been of literary material read aloud. This test used genuine spoken material selected on linguistic principles, and recorded on tape.
3. The test used multiple choice answering techniques so that it could be marked objectively (an unusual feature in a test of oracy). Thus standardisation was possible. Validation was carried out three times on samples of equivalent population.
4. As a result of validation the seven sections of the test were reduced to six. It emerged that each section was pulling its weight in the test with no serious duplication.
5. Correlations of test results with measures of oral ability, written ability and IQ were very satisfactory; and suggest that there is a distinct listening factor as indicated by other researchers.

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EDUCATIONAL AND INTELLECTUAL DEVELOPMENT AMONG CANADIAN INDIANS AND ESKIMOS

by PHILIP E. VERNON

*Professor of Psychology, University of London,
Institute of Education*

PART II

I. TEST RESULTS

PART I discussed the background, education and characteristics of 50 Eskimo and 40 Indian boys, aged about 11 years, who were interviewed and tested in Canadian schools. We turn now to the tests of abilities and comparative results. These tests have been described elsewhere (Vernon, 1965).

The scores on all tests in an English standardisation group were converted to deviation quotients with a mean of 100 and a standard deviation of 15. The 90th, 50th and 10th percentile scores of Indians and Eskimos are shown in terms of these quotients in Table II. Thus their median Arithmetic test scores falls at 1.6 standard deviations below the English mean and is equivalent to an Ar.Q. of 76. The group tests were also applied to a white sample in Calgary schools, and it was confirmed that their scores were closely similar to those of the English sample, with three exceptions, to be mentioned below.

Arithmetic. Both groups were very backward (median 76). There was little difference between subgroups, but the best 10% of Indians did not, like the Eskimos, come anywhere near the English average. However, the test used emphasises conventional fundamentals—the four rules, weights and measures, and simple operations up to fractions. The province of Alberta had recently introduced the new mathematical approach, which gives less practice in these elementary processes. Thus white children in Calgary achieved a mean quotient of only 91, and one might reasonably say that the Indians and Eskimos are 15 points below this mean rather than 24 below the English mean. Teachers of Eskimos and Indians believe that they do relatively better at arithmetic than at more verbal subjects. Our obser-

variations indicate that they are seriously handicapped by the new mathematical approach, because of its high verbal content.

English: Spelling. In this drill subject Eskimos (at 97) are little below the English average, though further behind Canadian whites

TABLE II

PERCENTILES FOR INDIAN AND ESKIMO BOYS, IN TERMS OF ENGLISH DEVIATION QUOTIENTS

Tests	Indian			Eskimo		
	90th	50th	10th	90th	50th	10th
Arithmetic	84	76	65	94	76	65
Spelling	112	87	74	116	97	78
English reading comprehension, usage	89	78	70	96	85	70
Group vocabulary	90	79	71	96	86	73
Terman-Merrill vocabulary	83	70	62	88	76	59
Information learning	94	72	55	108	82	59
Word learning	101	75	56	123	87	62
Concept formation	110	91	80	119	104	86
Piaget total	94	73	62	102	83	62
Abstraction	93	82	69	106	91	74
Matrices	94	81	69	101	89	72
Gottschaldt (Embedded Figures)	103	86	66	108	94	75
Goodenough Draw-a-Man	115	96	73	117	95	72
Draw-a-Man (Witkin scoring)	116	101	86	117	101	80
Porteus mazes	106	98	80	116	95	74
Picture recognition (3-D perception)	105	91	79	109	95	77
Reproduction of designs	107	91	73	108	89	74
Kohs blocks	101	88	73	109	88	71
Formboard	105	85	63	111	87	62

who scored an average of 110. Indians are moderately backward (87), but both groups contain a number of superior spellers.

Reading Comprehension and Usage and a group multiple choice *Vocabulary* test gave similar results (Eskimo 85, 86; Indian 78, 79); but it is noticeable that these figures are much superior to those for individual *Terman-Merrill Vocabulary* (76 and 70 respectively), where the child formulates his own definitions. One might suppose that non-whites are handicapped by the unfamiliarity of multiple choice tests, and it has been said that Indians are particularly cautious, not liking to commit themselves to guessing. Our results suggest, contrariwise, that both groups can make fair progress with classroom English, and can cope with the conventional group tests of attainment provided these are adequately explained and demonstrated. The

majority, too, show fair oral fluency. But these conceal a basic lack of understanding of English concepts, which may be largely responsible for their difficulty in progressing to work of secondary standard. The same point was made by the *Information Learning* test, where the tester reads out a series of 15 simple statements of fact and afterwards asks a question on each. Canadian whites averaged 107, Eskimos 82, Indians 72. The teaching of English in Canadian white schools is probably better than that in England; the pupils are more advanced in picking up meanings. But a different approach seems to be needed for aboriginal children from non-English-speaking homes.

The distinct superiority of Eskimos to Indians on all these tests can probably be explained in terms of greater usage of English in the homes and in the Inuvik hostel. But in addition there may be more resemblance in grammatical structures between Eskimo and English (both languages involving agglomerations of elements) than between the two Indian tongues and English.

Word Learning. This is a more mechanical task involving studying and reproducing a list of 20 verbs, which probably depends as much on willingness to concentrate on a dull task as on linguistic ability. The Eskimo and Indian means were 87 and 75 (similar to those on group English tests), but Cluny boys were markedly less cooperative than Morley in the group tests, and the medians of these subgroups were 72 and 81 respectively.* On other educational tests there was little difference between them, possibly because the poorer home background at Morley may have been compensated by a particularly good school atmosphere and teaching.

Concept Formation. This test involves sorting miscellaneous objects into self-chosen categories and abstracting the common features. Linguistic skill has little to do with it since Eskimos and Morley Indians obtained medians of 104 and 97 respectively, though Cluny were poorer at 89. There was no indication that attitude or motivational factors depressed the Cluny score, and it may be merely that the Blackfoot language and thought structures do not generalise so readily as the Stoney and Eskimo.

Conceptual Development. On a battery of tests derived from Piaget, total scores were closely similar to those in individual vocabulary (83 and 73). The Tuktoyaktuk subgroup, which appears to live in the most restricted and unvarying environment, was noticeably poorer

* No tests of significance of differences are quoted here. But as the standard deviations of subgroups on most tests average around 12-13, differences between subgroups numbering 20-25 would be significant at the .05 level provided they exceed about 7 points of deviation quotient.

(73) than the Inuvik hostel and town boys (84). However, performance varied widely on different tasks, perhaps depending largely on specific environmental experiences in the different cultures. All groups were weak on conservation of liquids, Plasticine, lengths and areas; out of 13 questions English boys failed 11%, hostel Eskimos 36%, town Eskimos 50% and Indians 56%. Thus performance does not depend simply on degree of acculturation. Time concepts and knowledge of left and right were weak throughout. On the other hand Eskimos were similar to whites, Indians poorer, in understanding shadows and the level of water in a tilted bottle, and in drawing a dot in the right position on a piece of paper. Indians were better in the "insect" test (cf. Vernon, 1965). Both were weak in number concepts (e.g. what is the biggest number you can make from 28493), but little inferior to English in logical inclusion and arranging equidistant counters.

Creativity. Five new individual tests aimed at creative abilities were added in this investigation: Torrance's incomplete designs (cf. Goldman, 1964), 3 of the Rorschach inkblots, Uses for a Tin Can, a story of "The Dog that Couldn't Bark", and "What I would do if I could fly". The scoring of these is so complex that a separate report will be published later. However some of the greatest deficiencies, particularly among the Morley Indians, appeared on the stories. On the incomplete drawings, on the other hand, there was little difference between English, Eskimo and Indian groups in imaginative choice of themes; and the Tin Can gave comparable results. On Rorschach, the Indian responses were numerous but of low quality (poor F%, many Dd, high perseveration), indicating a very restricted or inhibited mental development. One might have expected such tests to be highly culture-bound, but in fact there was surprisingly little difference in content. Lions, flying saucers, negroes turned up in Indian and Eskimo responses, just as toboggans, tents and beavers did in English.

Inductive Reasoning. Two tests were given, a group Abstraction test based on letters, numbers and words, and a creative-response non-verbal Matrices test. The results were similar: Eskimo 91 and 89, Indian 82 and 81. Thus the Indian deficiency is, if anything, greater than on verbal and educationally-loaded tests, though still well above the figure obtained for Jamaican boys of 75 (Vernon, 1965). The hostel group was again a little superior (93 vs. 88-9), and Cluny was better than Morley on Matrices (84 vs. 78). Performance at such tests would doubtless be affected by conceptual and linguistic struc-

tures of the cultures, which would be difficult to pin down; but the results also suggest an association with encouragement of intellectual initiative or thinking for oneself. Morley Indians are a particularly repressed community, and the hostel Eskimos have probably had most opportunity to develop self-reliance. Jamaican upbringing, both at home and at school, is highly repressive. The same pattern emerged in the:

Gottschaldt or Embedded Figures Test. This is similar to one of the tests used by Witkin *et al.* (1962) to measure "field independence". The medians were: hostel 95, town Eskimos 93, Cluny 93, Morley 82; (however here Jamaicans obtained 88). Witkin supplies strong evidence of association between analytical-independent perception in boys and the encouragement of independence, confidence and objective thinking in their upbringing. Another of the tests he employs is human figure drawings, scored more for clear perception of body parts and their articulation, for action and expression than, like Goodenough's scale, merely for inclusion of details.

The Draw-a-Man Test was applied and scored both by Goodenough's scheme and by a short scale based on Witkin's criteria. The median quotients were:

	Hostel	Eskimos			Indians	
		Town	Combined	Morley	Cluny	Combined
Goodenough	95	94	95	87	99	96
Witkin	106	98	101	101	99	101

All these figures are high in comparison with most other tests, bearing out the reputation of N. American aboriginals for artistic talent. In restandardising the Goodenough scale, Harris (1963) obtained drawings from 318 Alaskan Eskimos, and these showed 1 to 2 years superiority to white norms over the 8-14 year range. But as his samples were sent in by teachers in Eskimo schools, it is unlikely that they were completely representative of the various age groups. Other studies (e.g. Macgregor, 1946) have shown average or superior scores on Goodenough among American Indians. Here the Indians and Eskimos obtained identical results on both scales; in fact the Indians obtained their highest score on Witkin. The hostel Eskimo quotient on Witkin (but not Goodenough) was again the highest, most of the boys drawing realistic seal-hunting scenes. But the Indian results are less consistent; the Morley group appeared to score badly on Goodenough's scale mainly because their art teacher encouraged impressionistic action pictures with little detail.

Porteus Mazes. This is another test involving drawing in which Eskimo and Indian scores are little below the white mean (98 and 95). Cultural experience in tracking and finding one's way in snow, waterways and woods may have contributed to this result. Here the outstanding score was that of the Tuktoyaktuk boys (102 vs. 93 and 90 in the hostel and Inuvik subgroups), and if Porteus is justified in his claim that the test measures planning ability, it is interesting that the home backgrounds of this group were rated most highly for planfulness and organisation (cf. Table I).

Three Dimensional Perception of Pictures. This test, which is said to give great difficulties in African cultures (cf. Hudson, 1962) was done fairly well by all the Eskimo groups and the Cluny Indians (median 95), rather less well at Morley (88).

Reproduction of Designs (Bender-Gestalt and Terman-Merrill). The medians of 89 and 91 fall in the same general range as those of other non-verbal tests, and there were no appreciable subgroup differences.

Spatial Ability: Kohs Blocks. All the above tests show considerable loadings on a spatial perceptual factor in English and Jamaican subjects. Kohs Blocks, with Jahoda's (1956) modification, seems to involve inductive and spatial practical abilities, being useful, for example, in selection for technical training. Like Abstraction and Matrices, it yielded very low scores among Jamaicans. Both Eskimos and Indians did somewhat better with medians of 88, but again there were subgroup differences: hostel 92, town Eskimo 84, Cluny 90, Morley 84.

Formboard (speeded). This was weakest of all among Jamaican boys, perhaps due to a combination of listlessness from undernourishment, and poor development of those perceptual and practical abilities which seem to be linked with masculine identification. One of the major reasons for seeking Indian and Eskimo samples had been to find whether the stronger male influence and encouragement to cope with the physical environment might be reflected in higher scores on this and Kohs Blocks and possibly other spatial tests, despite the similar deficit of Jamaicans and Canadian aboriginals on linguistic tests. The hypothesis was borne out by medians of 87 (Eskimo), 85 (Indian) and 68 (Jamaican), though the Indian-Eskimo figures are still well below white standards. However the subgroup results are interesting: Cluny again surpassed Morley (89 vs. 82), but the hostel Eskimos were much below the town ones (80 vs. 92). Undernourishment certainly does not enter here, and it seems more likely that town Eskimos

would have had more opportunity to play with models and bricks than Eskimos living on the land.

2. DISCUSSION AND CONCLUSIONS

Our first major finding is the variation of scores (relative to English standards) on different tests, even on tests which might superficially seem to be "culture-fair". It is impossible to infer that these aboriginal groups differ in genetic general intelligence from whites when their quotients on Mazes, Draw-a-Man, Kohs Blocks, Gottschaldt, Designs, Inductive Reasoning and Concept Formation range from 88 to 104 (Eskimos) and 86 to 101 (Indians). At the same time, while the most serious deficiencies occur in individual vocabulary, arithmetic and several of the Piaget concept-development and the verbal creativity tests, where linguistic difficulties are obviously operating, it would be equally unjustifiable to claim that these groups have the same educational and vocational potential as whites. The whole pattern of their culture, including health conditions, isolation from and suspicion or apathy towards intellectual stimulation, the stress on immediate gratification and generosity rather than internalised controls and planning, and the lack of any clear and worthwhile vocational future, all combine to reduce their effective intelligence—that of our Indian groups more than that of the genetically similar Eskimos.* The gradual modification of maladaptive values, the general adoption of English in the homes, and the development of an acceptable economy to replace that of the past, will require generations of progress.

It is not only our test results that suggest a "built in" (rather than inborn) deficit. The Canadian aboriginal has seldom been repressed or suffered from as much prejudice as the American negro, yet he has failed signally to produce anything like the same proportion of leaders, professionals and other outstanding men as have the negroes (except in so far as he has intermarried and become completely absorbed into the white culture). The main reasons must surely lie in the linguistic factor, the absence of any clear avenue to economic progress, and the tenacity with which many Indian groups reject acculturation. One should also bear in mind that, although our sample represented complete age groups of children at school, at least one quarter of aboriginal children of the same age are not at

* Possibly the lower scores of Indians than Eskimos on most tests might also be explained by natural selection, survival of the fittest having operated much more severely among the Eskimos.

school, and many more—especially among the Metis—obtain much less regular and well-organised schooling. Had they been included the general level of test scores would certainly have been lower.

A common pipe-dream among teachers and educational psychologists is to ask for a test which will diagnose educability, regardless of abnormal preceding environmental conditions. The difficulty in meeting this is shown not only by the variations we have found in subgroup scores which seem to be attributable to such general environmental conditions as cultural level and planfulness of the home, and encouragement of initiative, but by the many evidences of the effects of specific experience on particular tests: the structural characteristics of the mother tongue, practice in artistic expression, possibly familiarity with tracking or with certain types of toys, etc. At the same time it would be extremely helpful to educational prediction and guidance if a psychologist could be attached to each school, or group of small schools (the same, of course, applies to schools in England containing immigrant children). He should give a rather varied battery of tests, so as to reduce the specific biases just referred to, but should weigh their results clinically against a full case history of family, health and educational background. (For example, tests might be better normed in terms of years of education than of chronological age.) He would also consider the actual progress made in English and other skills during the initial years in school. This should yield a far better assessment of potential than the results of any allegedly culture-fair test alone. At present there is not only an almost complete absence of educational psychologists in Indian and Eskimo schools, but also school records are generally inadequate. Often the principal or staff knew the family well, but in other cases there was scarcely any information because of language difficulties, or inaccessibility or unwillingness of the parents. Though the tests used in our research could form a useful nucleus for 10 to 12 year olds, much more experimentation would be needed to find ones that could be got across to younger pupils.

Our second major finding is the rise in scores on most inductive reasoning and perceptual-spatial tests, associated with a more resourceful and independent mode of existence, and stronger masculine identification in the upbringing of boys. Our Eskimo groups show that these abilities are not necessarily dependent on acculturation and familiarity with the spatial products of white civilisation (though it may be that the Blackfoot Indians at Cluny surpassed the Stoney Indians largely for this reason). While our attributions of

causal factors in test score variations are obviously speculative, this one fits in so well with previous inferences from West Indian and English samples (and was indeed hypothesised beforehand), as well as with the researches of Witkin, that we can claim considerable scientific justification. So far, only the subgroup differences have been analysed; further light will, it is hoped, accrue when individual test scores and background factors can be correlated. Incidentally these results suggest a greater aptitude among Eskimos and, to a lesser extent, Indians for technical training than for more academic types of education. Another interesting point suggested by the writer's earlier investigations is confirmed here, namely that the emotional security of an "unbroken" home is apparently much less important in the development of abilities than Western psychologists are apt to assume.

A further finding that should be particularly stressed is the discrepancy between genuine understanding of English and performance on English group tests; both multiple-choice and short-answer tests were done much better by Jamaicans, Eskimos, Indians and Gaelic-speaking boys in the Hebrides than were the individual vocabulary and verbal creativity tests. Many educational problems were raised by this research, e.g. in connexion with the teaching of English and arithmetic to handicapped pupils, the motivation of adolescents, etc. But it would seem rather foolish to attempt to comment on these or to suggest solutions on the basis of only a few weeks' observations in a few schools.

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STREAMING IN THE SECONDARY SCHOOL

by D. THOMPSON

Headmaster, The Woodlands School, Coventry

I. INTRODUCTION

STREAMING implies selection into groups with a fairly narrow range of ability as measured by some test or other. The opposite concept is that of mixed ability groups. Mr W. H. Jenkins, a headmaster, writing in the *Times Educational Supplement* in 1963, said: "The object of streaming is to separate those children who are capable of working at a fairly rapid rate, and of making good progress, from those whose intellectual limitations demand an easier pace." Another headmaster, Mr J. L. Carr, in the same issue, wrote: "Streaming sounds more efficient. It ought to be more efficient. Its theory is unquestionable." Sir Cyril Burt has said: "The case for streaming is of such logical force that anyone to whom it is explained is immediately convinced."

Note, however, that these opinions are based on the assumption that the chief purpose of education is the inculcation of knowledge. What if it could be shown that streaming led to undesirable social consequences or hindered the establishment of sound personal standards and relationships? Clearly the arguments in favour of streaming depend on what one is seeking to achieve during the process of education. If one sees this as the learning of subjects in the traditional academic sense then the arguments in favour of streaming of some kind appear to be fairly strong, although there is an increasing weight of evidence to suggest that streaming is not so efficient overall as its advocates maintain. If, on the other hand, one regards the educative process as being concerned largely with the promotion of attitudes, then the arguments in favour of streaming are very slender indeed. In so far as we believe that education is concerned with both these things, the answer might be expected to lie along a middle path somewhere between a system of rigid streaming and one of non-streaming. During the past few years, the writer has searched for that optimum system, with the minimum degree of segregation, that

will offer the best of both worlds—good academic results by the end of the fifth year, together with sound personal development and good social attitudes.

Historically speaking, streaming is a relatively new feature in English education. The grammar school knew nothing of it for over 700 years and, even to-day, many public schools with quite “dull” pupils know nothing of it. It was really the Hadow Report of 1926 and its advocacy of a clean break at eleven years that marked the onset of streaming as an accepted practice in English schools. Prior to this, backward children simply remained in a lower class, which led to a situation in which children of eight years were taught with backward children of thirteen years. The word “streaming” did not actually appear, however, in the Hadow Report and it was not until 1931 that official recognition of streaming appeared. The Primary School Report for that year said: “The break at eleven years has rendered possible a more thorough classification of children”, and went on to speak of A, B and C classes that would cater for pupils of different abilities. In recent years, streaming has come under critical review largely because of two things: the necessity to examine educational processes against the background of the society in which the child lives, and a less rigid adherence to the theories of intelligence and innate ability. Nevertheless, most members of the teaching profession still believe that streaming is educationally sound, at least in the secondary school.

Occasionally, however, a few voices are raised in favour of non-streaming. Pedley, for instance, wrote: “If non-streaming works up to the age of eleven, need it be cut short there? There is every reason to expect that classes of mixed ability will gradually be tried out in the first three years of the secondary school, not merely in non-academic subjects, but in the basic subjects too.” A headmaster wrote: “Always in our minds is the knowledge that to segregate is to condition the children to give a certain level of response. We have no evidence that the able children suffer in any way. Unstreaming brings higher achievement from very many children. It ends discipline troubles and is a sure basis for a happy school. It is a fairer way.”

Nevertheless, the theoretical arguments in favour of streaming do appear to be more powerful than those against streaming, largely because we have been conditioned by years of educational thinking based on the concept of innate ability. It is this theory which is the greatest hindrance in our minds to the acceptance of non-streaming as a possibility in the secondary school. Such a theory inevitably

leads to a belief in the possibility of discovering how much ability a person has, following which it seems reasonable to group together, for purposes of instruction, those with the same amount. The idea that one can form stable groups of pupils having the same capacity for learning is the natural consequence of such a theory.

We now know that there is much more to being successful in school than the advocates of the theory of innate ability realised. A pupil's performance is now seen to be a dynamic function of many variable factors, most of which are quite unrelated to inborn mental capacity, and the idea of the fixed, stable, homogeneous group is rapidly becoming out-moded. Motivation becomes all-important, as also do other factors such as group spirit and group attitudes, self-confidence and group esteem, incentives and encouragement, home conditions, the pupil-teacher relationship outside the classroom and within, parents' identification with the school, the skill of the teacher, methods of selection, to mention but a few.

The reason why streaming has appeared to work in the past arises from its self-fulfilling nature. As Michael Young has said: "Children conform to the expectations that teachers have of them and to the expectations that they consequently have of themselves. Hence streaming helps to determine the achievement of children and the less-able become less-able because of the expectation that this is what they are." We may add, "Those chosen for the 'A' stream become more able because of the expectation that this is what they are." That is not to say that one could take any 30 children and expect them to gain five "O" level passes after five years simply because they were placed in the "A" stream, but they would certainly stand a better chance of so doing than if they had been placed anywhere else. The important part played by conditioning must, in the future, receive greater recognition and the part played by inborn mental ability must be seen to diminish in importance.

2. AN EXAMPLE: THE WOODLANDS COMPREHENSIVE SCHOOL

In September 1962 The Woodlands School took in 129 boys whose Verbal Reasoning Quotients ranged between 108 and 135 inclusive. These boys were placed in four parallel forms designated 1A, 1B, 1C and 1D and were given a common course for one term with a common examination at the end of it. No attempt was made at that stage to stream the pupils and they continued in these forms until the end of the year when, on the evidence of their performance in an examination in six basic school subjects (English, Mathematics,

French, History, Geography, Science), those 100 pupils deemed to be the most promising academically were taken out and re-grouped into three parallel forms designated 2A, 2B, 2C. All the pupils in these three forms have been taught a similar syllabus since then, with a common examination at the end of each year. They are now in their fourth year and are still in the same parallel forms designated 4A, 4B, 4C. The analysis which follows is based on a consideration of their performance in examinations taken after being in the school for one term, one year and three years (1).

Of those 30 boys who came top in the school after *one term*, using the evidence of six subjects, only 19 of them came in the top 30 places in the examinations taken six months later at the end of *one year* and only 16 of the original group came in the top 30 places two years later at the end of the *third year*. If we inquire how many of these boys consistently came in the top 30 places at the end of one term, one year and three years, the answer is 11 of them, or approximately one-third. In view of this, one might be tempted to suggest that it would have been unwise to have taken out, after one term, those pupils who were in the first 30 places and formed them into an "A" stream. It might have been better to wait until the end of the year before taking out an "A" stream.

Of those 30 boys who came top in the school after *one year*, using the evidence of six subjects, we find that 18 of these still occupied places amongst the top 30 after *three years*. In retrospect, 18 of them (not the same 18) are also to be found in the list of pupils who occupied the top 30 places at the end of *one term*. Only 11 of them were consistently in the top 30 places after one term, one year and three years.

If the 11-plus results had been used to stream the pupils on entry to the school, the situation would appear to be much worse. Of those boys who occupied the top 30 places on the 11-plus list when they entered the school, only 13 are to be found in the top 30 places in the school examination taken after *one term*. Ten of them were still in the top 30 list at the end of *one year* and 11 after *three years*. Only five of the original group consistently came in the top 30 places on entry, after one term, one year and three years.

If, finally, we look at those pupils who formed the top 30 list on the evidence of seven subjects at the end of *three years*, we find that only 11 of them were in the top 30 on entry to the school, 15 are to be found in the top 30 examination list produced after *one term* and 18 on the list produced after *one year*.

Looking at the list of those 11 boys who consistently came in the top 30 places after one term, one year and three years, it is seen that their VRQ's ranged between 112 and 123 inclusive, and their positions on the VRQ list ranged between 11th and 91st inclusive. Only four of them were in the top 30 places on entry to the school. These boys may reasonably be described as the most able academically in the present fourth year.

If we examine the three separate lists showing the pupils who occupied the first 30 places after one term, one year and three years on the evidence of six or seven basic subjects, there are 50 different names, of whom 11 appear in all three lists. Regarding these 11 boys as deserving a place in the top stream, if one had been formed at any stage during the first three years, and choosing 19 others from the remaining 39 in order to make up a top stream of 30 pupils, leads to a situation where there are ${}^{39}C_{19}$ choices. In practice we can only form one of these seventy thousand million different streams, which we do in an arbitrary manner, believing we have chosen the best or the right one. This is not the case, but because the group we have chosen ultimately does as well as any other would have done, we regard this as confirming the rightness of our choice. This is acceptable as far as the group chosen is concerned but rather hard on those others who have been rejected, but who with equal validity might have been chosen and who would, if chosen, have done equally as well. This, of course, represents a strong argument in favour of parallel forms.

Whether we stream after one term or one year or three years, it is interesting to note how many of the pupils chosen for the top stream on the evidence of six or seven subjects, actually come in the first 30 places in those subjects looked at individually. If, for instance, we examine the group who occupied the top 30 places in the school after *one term*, then only 19 of them were to be found amongst the top 30 in Mathematics and would have been chosen for the top set in that subject if setting had taken place. Only 15 were still in the top 30 list for Mathematics at the end of one year and only 9 were still amongst the top 30 Mathematics pupils at the end of three years. The table at top of p. 201 shows the situation in other subjects.

If the choosing of a top stream had been delayed until the end of the first year, the choice would have been slightly more accurate in respect of individual subjects. E.g. of those pupils who occupied the first 30 places in the school examination after *one year*, 16 were also in the top 30 list for Mathematics at that time, 12 of them were still in the top 30 Mathematics list after three years and 18 of them

NUMBER OF PUPILS IN FIRST 30 PLACES IN 7 SUBJECTS

after 1 term after 1 year after 3 years

Mathematics	19	15	9
English	16	13	10
French	19	15	12
History	17	14	11
Geography	19	10	12
Physics	} 17	} 15	10
Chemistry			4
	—	—	—
	107	82	68

had previously been in the first 30 for Mathematics at the end of their first term.

If we finally look at the list of pupils who occupied the first 30 places on the evidence of seven subjects after *three years* in the school, then it is apparent that more of those chosen for the top stream would find their way into the top sets in individual subjects under a system of setting.

One final statistic seals the argument against any form of rigid streaming during the first three years. An examination of the results of those boys who occupied the first 30 places in Mathematics at the end of three years shows that only 7 of them were in the top 30 places on the 11-plus list on entry to the school, 9 of them came in the top 30 places after being in the school for one term and using the results of six subjects, 12 were in the final order of merit list at the end of one year and 12 were in the final order of merit list based on seven subjects at the end of three years. Figures for other subjects are as follows:

NUMBER OF BOYS IN TOP 30 PLACES AT END OF THREE YEARS IN 7 SUBJECTS
WHO WERE ALSO IN TOP 30 PLACES USING:

	6 subjects after 1 term	6 subjects after 1 year	7 subjects after 3 years	VRQ list on entry
Mathematics	9	12	12	7
English	10	10	16	7
French	12	11	17	12
History	11	14	16	8
Geography	12	13	14	8
Physics	12	12	19	9
Chemistry	10	12	19	11
	14	11	19	—
	—	—	—	—
	78	83	113	62

Any stream that is formed, by whatever method, will be unstable in so far as it will not contain, even initially, the pupils whom it is supposed by definition, to include, and the situation will get progressively worse as time goes on. It is obviously impossible to choose a stream on the basis of all-round performance in basic subjects and at the same time ensure that its members, generally speaking, will be in the top 30 places for the subjects considered individually. The logical conclusion, therefore, appears to be setting for individual subjects so that the top set in French is known to contain those 30 pupils who are best at this subject. For a small school, setting is possible in certain subjects for certain years, but there is no school in existence that could write a time-table which permitted setting in every subject throughout the whole five years.

3. SETTING

The writer disapproves of setting for reasons other than the limitations imposed by the time-table and does not use the system at all. In effect, it is a disguised form of streaming which seriously limits the attainment of all pupils except those placed in the top set. Apart from this personal view, however, the statistical arguments against setting are as strong as those against streaming. An analysis, for instance, of the group of pupils who occupied the first 30 places in Mathematics after being in the school for *one term*, shows that only 19 were still in the top 30 Mathematics list six months later and only 12 were still there after three years. Of the original 30, only 9 consistently came in the top 30 places for Mathematics at the end of one term, one year and three years. These 9 boys we may reasonably regard as being the most able mathematically in the present fourth year. Figures for other subjects are shown below:

	In top 30 places after			In top 30 places on all three occasions
	1 term	1 year	3 years	
Mathematics	30	19	12	9
English	30	17	12	7
French	30	19	15	10
History	30	16	13	8
Geography	30	13	11	7
Physics	} 30	} 15	10	6
Chemistry			9	7
6/7 subjects	30	19	16	11

From this it would appear that using a pupil's performance in six basic subjects after one term is more accurate in respect of

choosing a stream than is the use of a pupil's performance in say History, or any other subject, after one term, in respect of choosing a set. But neither is good enough to justify streaming or setting.

Within a large school, therefore, it is impossible to choose a stable set of 30 pupils of whom it can be said with any confidence at any subsequent stage, "The right pupils are in the right set." Further, it is much more difficult to choose a group of 30 from a sample of 300 than, say, a group of 100 from the same sized sample. This is why the writer prefers to choose a group of 100 pupils and say of them, "These are the one hundred pupils who, generally speaking, are best at most school subjects", and proceed to divide them into three parallel forms without any setting whatsoever. Even here there is inaccuracy but it is not so much to the pupil's disadvantage as when one arbitrarily chooses a smaller group.

Generally speaking, the smaller the group being chosen, the greater the inaccuracy in either streaming or setting. The possibility of being able to stream with some degree of justification is an inverse function of the number of pupils in the year group and directly proportional to the number of pupils being selected.

Thus, at Woodlands School we would find it more difficult to stream rigidly with a yearly intake of 300 pupils than would a smaller school of intake, say 200, assuming streams of the same size. On the other hand, the smaller school would find it more difficult if streams of only 10 pupils were being selected.

4. THE FUTURE

There will be strong resistance to the idea of non-streaming in the secondary school for a long time to come. This will diminish as it becomes obvious that it does not lead to lower academic standards being attained by those pupils who in the past have been regarded as being more able than the rest. It is equally important, however, that the theoretical basis of our prejudice against non-streaming should be removed and this will only come about as we examine afresh accepted theories of learning and recognise the important part that conditioning, as opposed to innate ability plays in attainment. Streaming in itself is a conditioning process which on the whole is favourable as far as pupils in the top stream are concerned but unfavourable to all those in the other streams because it conditions them to a level of response below that of which they are capable. If streaming had to continue, then there is a strong argument in favour of the small school, containing one stream, if possible, but two at the

most, in order to minimise the harm done by streaming. Critics of the comprehensive school who say that a pupil is better off in the top stream of a secondary modern school than in the fourth stream of a comprehensive school are absolutely correct. This is not a criticism of the comprehensive school, however, but a condemnation of streaming.

Future theories of learning must take into consideration the importance of a pupil's belief in the possibility of doing well. Experience suggests that success in school is more closely related to certain personal attitudes and qualities, such as self-regard, than it is to performance in 11-plus type tests in which pupils with little self-esteem often score quite highly. Education must, therefore, concern itself with the promotion of attitudes as much as with the inculcation of facts, since these form the basis of future progress or lack of it. Many pupils do not achieve much because they have come to regard themselves as incapable of much, and streaming, coming after selection at eleven years, reinforces the view they already hold of where their rightful place is and reduces the ceiling of their attainment still further. Certainly there are inborn differences in learning potential, but they are not as absolute as we have previously regarded them. Education is concerned with the conditioning that has taken place over the years, first in the home and later in the school. It is up to those concerned with the business of education not to aggravate the situation further by imposing systems involving segregation whether into different schools or into different streams within the same school. To do so lowers the potential of all except those placed in the top stream in the best school.

NOTE

1. A considerable amount of research is still needed in order to decide the most accurate method of using examination results to separate a school population into streams. Experience suggests, however, that the use of positions, as opposed to marks, leads to the most accurate prognosis of a pupil's accomplishments. And the more subjects that can be taken into consideration, the more accurate this will be. In deciding which pupils have come top in the school examinations, therefore, the writer has added together the six or seven positions gained by each pupil in basic subjects and ranked the resulting totals to produce a final order of merit list.

THE DIMENSIONS OF ABILITY IN ENGLISH COMPOSITION

by E. PERCIVAL

Boteler Grammar School, Warrington

I. INTRODUCTION

IN a previous article in this journal (November 1965), some suggestions were made about the nature of the elements which constitute ability in work in English composition. These measures, it will be recalled, were relatively objective in recognition and measurement and the final overall picture provided by the article may well have been an over-simplification of the complex nature of composition ability. Hence, in the title of this article, the metaphor "dimensions" is used to convey the idea that a piece of composition work is not merely the sum of the number of words, sentences, punctuation marks, and so on, but is rather the spontaneous integration of all these elements to produce a single, composite work. At this point it is important to note the word "spontaneous", for the final test of composition ability includes the use, whether conscious or not, of the literary devices and elements previously described to produce the writer's object, however humble that may be. Composition work in words is, in these terms, a product with dimensions in which the elements are mixed together to produce a unit greater than the sum of its parts. The object of this article is to consider first the extent to which these elements are co-related and second the concept of "quality" as an expression of the ensuing unity.

The material of this article has been selected and shaped so that it may be relevant to some of the problems raised by the recently published Working Paper, No. 3 of the Schools Council (1965).

The compositions on which these investigations were based were the work of the 11+ age-group of the English county borough, consisting of 644 boys and 680 girls. From the original scripts, two smaller groups each of 102 cases, one of boys and the other of girls, were selected in order to reduce the laborious work of calculating correlations (no computer being available). In each of these groups the number of IQs within an interval was in proportion to the number

in the population as a whole, i.e. the two smaller groups were proportionally representative of the larger groups.

2. CORRELATIONS WITH COMPOSITION MEASURES

The object of this stage of the experimental work was to find out how far a number of objectively obtained measures found in composition work were inter-related. The measures used were:

- (a) number of words written ("fluency");
- (b) number of words in a sentence;
- (c) extent of the use of co-ordinating conjunctions;
- (d) variety in the use of punctuation marks and arrangements;
- (e) extent of the use of subordinating conjunctions;
- (f) incidence of effective language.

(For further details of these measures, reference should be made to the previous article.) In addition, scores of IQ (Moray House I 42) and EQ (Moray House E 19) were available.

The relations between IQ and these elements are shown in the following:

		(a)	(b)	(c)	(d)	(e)	(f)
		<i>fluency</i>	<i>sentence length</i>	<i>co-ord. conjs.</i>	<i>punct.</i>	<i>sub. conjs.</i>	<i>effective language</i>
IQ	boys	·57	·40	·31	·53	·28	·51
	girls	·52	·36	·34	·48	·34	·43

The most remarkable feature about these coefficients is their lowness, especially in view of the fact that they are measures of elements of the same skill. None of them would be accepted by an investigator as evidence of close relationship, i.e. the presence of one element giving high expectance of the presence of another. But the lowness of such coefficients is interesting and suggestive, for it follows that by taking a measure of IQ we are not taking a measure of composition ability as reflected in these elements. It is particularly interesting to note the low correlation between IQ and the use of subordinating conjunctions. At this point, where relationships are most in evidence, we might have expected to find a high relationship, but the results presented here do not support such a supposition. This further suggests that skill in composing in words is not an "automatic" or "natural" process which will follow spontaneously as a result of intellectual ability. We may consider that this skill depends to some extent at any rate on training and instruction.

If we measure the relationship between EQ and these elements, we do not find any more convincing relationships. The coefficients are as follows:

	(a) <i>fluency</i>	(b) <i>sentence length</i>	(c) <i>co-ord. conj.</i>	(d) <i>punct.</i>	(e) <i>sub. conj.</i>	(f) <i>effective language</i>
EQ						
boys	·61	·45	·37	·52	·25	·62
girls	·57	·45	·35	·43	·46	·54

Thus, it should not be uncritically assumed, either in the classroom or examination-room, that a standardised test of English is an adequate substitute for a measure of composition ability, even in so far as that ability can be seen in the presence of these six simple and isolated elements. This calls for a return to the metaphor of "dimension". Although skill in sentence formation, punctuation, use of conjunctions etc., may be shown and measured by the administration of a standardised test in English which gives an EQ, it does not follow that such skills will be used *spontaneously* when composition is written, i.e. in the true testing situation of verbal composition. Indeed, we may begin to think of "spontaneity of style" (to coin a phrase) as being an important element in composition skill. The inter-relationships between the remainder of the measures are as follows; girls' coefficients are shown in italics.

	(a) <i>fluency</i>	(b) <i>sentence length</i>	(c) <i>co-ord. conj.</i>	(d) <i>punct.</i>	(e) <i>sub. conj.</i>	(f) <i>effective language</i>
(a)		·34 ·29	·57 ·56	·38 ·43	·52 ·52	·51 ·58
(b)			·45 ·45	·27 ·12	·44 ·51	·34 ·29
(c)				·25 ·20	·33 ·29	·29 ·30
(d)					·23 ·29	·44 ·50
(e)						·32 ·30

Again we are most aware of the relative independence of the measures; we cannot afford to ignore any element on the assumption that its presence will be guaranteed by another skill. Incidentally, it is interesting to note how close the coefficients are for boys and girls.

At this age, there would seem to be no appreciable sex difference in these verbal skills. The closeness of the coefficients suggests the validity and reliability of the original measures.

3. THE CONCEPT OF GENERAL COMPOSITION QUALITY AND ITS MEASUREMENT

Since the elements necessary in composing with words seem so *relatively* independent of each other, the next quest is for a concept which binds these together and which thus produces the "dimensions" of the title. It would be useful if an assessor could mentally combine these elements into a single concept. This would be by its very nature a highly complex task. We must, however, produce somehow a method of differentiating between the relative merits of pieces of verbal composing, not only as part of an examination system, but as a means of testing the effectiveness of methods of teaching composition. If we produce new approaches to and methods of teaching English composition, we shall need some means of measuring the relative success of such methods. It is worth considering whether such a test might be found in what has generally been called the "general impression" method of marking in which the assessor avoids the use of prepared schedules of marks for named elements ("schedule" method) and gives some sign of "general merit" as a result of his "general impression" of the composition. The difference between these two methods, the "general impression" method and the "schedule" method, is not as great as might be thought at first glance. The "schedulers" are often looking for the elements of composition which are normally recognised as constituting composition skill; their difficulty comes in apportioning marks to such skills and in combining these marks finally. On the other side, the "general impressionist" who is worth his salt will hardly conduct his business in such a way that he writes down at the end of reading a composition the first mark which comes into his head. If he is at all competent in his job, he will surely be guided and influenced by his literary training and sensitivity, in the widest sense of these words. He will be aware of the elements described in these articles as constituting composition ability and he will try to make allowance for them when he comes to make his final assessment. In this way, he is not very far from the "scheduler". Here it is interesting and relevant to refer to the instructions given to markers by "a confirmed 'general impressionist'" (Wiseman, 1949) because he points to specific qualities to be looked for, though he makes it quite clear that his primary object is not to

mark literary excellence but to estimate ability to benefit from secondary education. It is very interesting and relevant to refer here to the investigation of Britton (1963) in which Wiseman's method of marking was adapted to be applied to the work of fifteen-year-olds. Here the final criterion was a combination of general impression marking with a mark for mechanical accuracy. In this arrangement we have a combination of the two main methods of marking.

Reference should be made here to the suggestions in the previous article concerning the idea of norms of performance at varying levels of composition ability. Such norms would be a useful guide to the marker as to where he should establish his standards. It is pleasing to know that the Schools Council recognised the importance of these norms at differing stages of development (Schools Council, 1965).

In this investigation the two smaller groups were assessed by the "general impression" method by three independent and experienced markers (lowest inter-marker correlation = .94). The evaluations were then correlated with some of the elements of composition ability. Again the coefficients were not particularly high, generally being in the region of .6. The correlations between quality and the other composition elements were as follows:

	(a)	(b)	(c)	(d)	(e)	(f)
	<i>fluency</i>	<i>sentence length</i>	<i>co-ord. conj.</i>	<i>punct.</i>	<i>sub. conj.</i>	<i>effective language</i>
Composition quality						
boys	.67	.45	.52	.59	.43	.61
girls	.59	.44	.41	.45	.52	.57

Thus we cannot arrive at an estimate of competence in composition by testing the elements of composition in isolation.

4. THE TREATMENT OF ERRORS

We now turn to a consideration of errors in composition work for two reasons. First, assessment has so far been proposed for positive qualities, whereas any consideration of error is usually of a negative nature. Second, the Schools Council raised the question of error in composition and its treatment. Accordingly it seemed relevant to consider here what the original inquiry had to say on this subject. It is usual to consider errors in written work under two main headings. There are on the one hand those errors which are mistakes in spelling. There are then the errors which arise from the process of composing, i.e. of putting words together. The second class in-

cludes errors of many differing kinds. Mistakes in punctuation account for a large number of errors in this class (see D. V. Smith, 1935) and in any serious study of this problem should be treated on its own with separate counts for different marks and practices. Mistakes in composing will arise from many different causes and these also should be considered separately and their incidence plotted against the stage of development of the writers. This inquiry isolated the incidence of errors arising from an absence of agreement between subjects, verbs, possessive adjectives etc., but in the final analysis did not treat these errors separately from the others, e.g. incomplete sentences, changes of tense, incorrect forms of pronouns, and so on. Comment here on error is of the most general kind.

An account of the statistical treatment of a consideration of errors in composition work is an involved and technical matter and outside the scope of this article. A full consideration of it is to be found in the work of Powell (1934).

Two concepts were developed for this inquiry—Accuracy of Composition and Accuracy of Spelling. These ideas presented a measure by which the composition was free from error. This was thought to be a useful approach since it was more in line with the positive treatment to which the compositions had been subjected. The two smaller groups of compositions were analysed for these features. It was found that the frequency of errors of both kinds tended to appear in the two samples according to the expectations of normal distribution. But beyond this, little relationship existed between either of these measures and the other composition elements. The highest correlations nowhere exceeded .67. The following table gives an idea of the correlation of these two measures with the others.

	(a) <i>fluency</i>	(b) <i>sentence length</i>	(c) <i>co-ord. conj.</i>	(d) <i>punct.</i>	(e) <i>sub. conj.</i>	(f) <i>effective language</i>	(g) <i>quality</i>
Acc. of comp.							
boys	.45	.48	.43	.50	.39	.50	.67
girls	.37	.46	.27	.26	.53	.30	.63
Acc. of spelling							
boys	.36	.23	.32	.50	.22	.47	.60
girls	.30	.37	.28	.22	.35	.32	.62

The question as to how much importance should be attached to errors in composition work remains one of the problems to which the Schools Council's pamphlet has drawn attention. We need to know

at what age certain skills in composition and spelling became the norm, for we must recognise that there will be different norms for different stages of development. Similarly we need to know the frequency with which errors appear. Such knowledge would be of great value in remedial work and also in normal class work where a teacher could be guided by what he could reasonably expect and avoid what would be beyond the scope of his pupils. In the field of measurement it is worth considering whether an analysis of errors, presented as norms of performance, may not be useful in calculating the effectiveness of teaching the skills of English composition.

5. THE NATURE OF COMPOSITION QUALITY

The final measure to be considered here is the nature of general composition quality as measured by a "general impression" method. It has already shown that the correlations between general composition quality and the separate elements were not very high. It was then asked whether the correlation of quality against a series of complex criteria might give any better results. The following examples show a general rise in relationship:

	boys	girls
Composition Quality / Eff. lang. + S.L. + Co-ord. + Sub.	.68	.68
/ Acc. Comp. + Acc. Spelling	.76	.71
/ Fluency + Acc. Sp. + Acc. Comp.	.83	.79
/ Fluency + Eff. Lang. + Acc. Comp. + Acc. Sp.	.93	.81

Of these particularly interesting is the coefficient of correlation of .93 for boys when quality is measured against fluency + effective language + accuracy of composition + accuracy of spelling. The suggestion here is that these may well be the elements that the marker is most affected by when he makes his assessment by the general impression method. Clearly this matter needs much further investigation, but this is at least a start in a field which has for so long defied any kind of progress. We may be here approaching something of a definition of general quality in composition work.

6. CONCLUSIONS

This study indicates that:

- (i) only moderate correlations were obtained between IQ and the six simple elements of composition ability;
- (ii) similarly there were only moderate correlations between these elements and EQ;

- (iii) between the elements themselves there were no high correlations;
- (iv) higher correlations were obtained when the elements were grouped together for complex criteria;
- (v) from all the foregoing, skill in composition should be regarded and treated as a composite whole.

The foregoing evidence and information suggests that achievement in English composition is a highly complex skill in the sense that it does not come with the practice of any one element. At its simplest, we can identify and isolate the fundamental elements of composition ability. But the final product is more than the addition of these skills; it calls for their integration. Miscellaneous exercises, on punctuation, sentence formation, choice of vocabulary, and so on, will not alone produce skill in composition. The final product calls for the integration of these elements, not merely their sticking together. They are ultimately interwoven and they thus form a highly complex product. Part of the skill of teaching composition lies in this action of integration. But more than this, the action of composing with words must be spontaneous in the sense that the writer, at whatever age or standard of achievement, must without any external stimulus or help, practise the skills on his own initiative. This ability includes the ability to recognise and correct errors or to write so as to avoid them. Clearly the teacher involved in English composition work is faced with a formidable task, but the evidence from this inquiry should make him feel that it is by no means impossible.

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ECONOMISTS AND EDUCATION

*A Review Article**

by R. SZRETER

Lecturer in Education, University of Birmingham

IT is only a few years since the Crowther Report brought about a wide realisation in this country that there is an important, legitimate, and practical economic standpoint in the discussion of educational issues. The Report (1), produced by a committee under the chairmanship of a distinguished economist, conducted the argument about the advantages and drawbacks of certain educational policies (notably that of raising the school leaving age) partly on the economic plane of costs and material benefits. It also adduced a wealth of economic statistics as evidence in support of its recommendations.

Had not the war disrupted the flow of national life and of scholarly activity, the economics of education might have come in for much attention twenty years earlier. On the eve of the war its problems were briefly but incisively discussed by R. H. Tawney (2), and also by H. L. Beales (3). As it was, the territory remained underdeveloped and neglected (except for two valuable contributions in 1955-56) (4), until the new discipline "arrived" with the publication of the Crowther Report in 1959. The Robbins Report (5) of four years later, its author in chief being again an eminent economist, was also imbued with economic flavour. Indeed, by 1966, when the Department of Education and Science came to take the enterprising step of publishing its own journal, the opening article of its inaugural issue (6) was about the economics of education. The economic approach to the strategy of education is now clearly "in".

Economists have "discovered" education—or, at any rate, rushed in to apply their methods and analysis to it—primarily because since about 1950 their most widespread and fashionable concern has been

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with the problems of economic growth. Clearly, education is of crucial importance here, whether as a determinant of the quality of a country's labour force, or the impelling force of its technological progress. This, at any rate, is the positive or "investment" side of education in economic life. It also has a "burden" or "consumption" aspect, in that it costs a lot of money. Moreover, this expenditure is made more painful by our uncertainty as to whether, how, and when, we get good value for this money. The vast and rapidly increasing sums expended in recent years on education have doubtless provided a further stimulus to investigations by economists. Thus in 1963-64 over £1,400 million of public money was spent on education in Great Britain, and the figure for 1964-65 is likely to exceed £1,500 m. Disregarding changes in the value of money because of rising prices, we may note that the corresponding figure ten years earlier was ca. £550 m., and that, therefore, the money cost of education went up two and a half times while in the same decade the money value of our gross national product increased by some 75%, so that the share of education gained considerably: from just over 3% to about 5% (7). A third reason for the proliferation of studies on education by economists has perhaps been the growing acceptance and use of economic planning in most countries. Because of its seminal importance, because of its size as an industry, and because of its relative "plannability" since its bulk is always in the public sector of the economy, the integration of education into overall economic planning has offered much scope to academic and policy-making economists (8).

The study of the economics of education seems to have three interrelated aspects. First, there are the costs of education, i.e. both the actual money costs and the estimated value of production (or, for individuals, income) forgone through a section of potential labour force being engaged in learning or teaching rather than in "producing". Here, studies include both statistical assessments of the costs and relating them to other aggregates of the national economy, as well as discussions on the best ways of financing educational expenditure, currently exemplified by voices demanding that the Exchequer should pay more and the ratepayers less for educational services. Secondly, there are the benefits from education, i.e. primarily the assessable, economic "returns to" it. These have been calculated for individuals on the basis of differential gains in income over a period accruing to those with comparatively more formal education. Similar estimates have been attempted for communities, in terms of ascribing differential increases in productivity and in national income to edu-

cational advances. A number of statistical methods have been evolved, all fraught with very great difficulties, as will be seen in the discussion of the American monographs. The third aspect is education as an industry, whose performance, i.e. efficiency in the use of its resources, bears investigating. This last is the least explored aspect of the subject. Since the misguided Victorian attempt to promote and test the efficiency of education by the system of "payment by results" (9), little attention has been paid to the economic performance of educators and educational institutions. John Vaizey, who between the appearance of the Crowther and Robbins Reports, was the most active and influential advocate of the economic approach to education in this country, noted the neglect of the "possibilities of reducing the unit cost . . . because the technology of education is not investigated, it does become stagnant . . . changes in technique have taken place in education [but] because their origin has been in pedagogical and psychological research, these changes have often been insulated from the pressure of the relative scarcity of different factors, and as a result have tended frequently to be cost-raising rather than cost-reducing" (10). Possibly—but then how does one measure cost relative to quality in education? It is extremely difficult, even if desirable, to apply here the common yardstick of industrial efficiency, viz. the lowness of cost per unit of output of given quality. A rare and important recent paper on the question of "Efficiency in Education", by F. Edding (11), readily accepts that "education, it is argued, has to do mainly with an incalculable growth process of the body and mind and with imponderable spiritual values", and goes on to say that the researcher must certainly make allowances for such values, but has little to say on how it should be done.

The bulk of scholarly output on the economics of education—and a recent bibliography (12) lists nearly 500 items—is American in origin. Otherwise Western Europe has, somewhat unexpectedly, produced more studies than the planned economies of European socialist countries (13). Of the four books which have prompted this article, three come from the United States, while that by Dr West is English.

The last is the "odd-one-out" in more senses, too. It is primarily concerned with our ways and means of financing education; but its aim is broader and more radical than to compare, say, the merits of the block grant against the pre-1958 arrangements, or to argue for altering the balance of expenditure between the central and local government. It is, in fact, a critique of the very presence of the state

in education. West maintains that the entry of the state into the sphere of education after the 1870 Act put a brake on and irreparably damaged the spontaneous growth of privately financed education in England. Conversely, he feels sure that things could be much better arranged to-day if the state would withdraw from education and return the tax money thus saved, in the form of educational vouchers, to parents.

This approach is refreshing in the extreme. So is West's use of nineteenth-century educational statistics in the valuable middle section of the book. It seems conceivable here, however, that the author did not ask how much literacy there was in mid-nineteenth-century England, but hoped that there was a great deal and set out to find it. Generally West presents his case with logic and vigour, although his book is anything but the "dispassionate analysis" claimed by the publishers. It is a most passionate essay, exhibiting an almost pathological detestation of "the state" combined with an almost blind love of the logical beauty of classical economic theory. West argues throughout *as if* self-regulating, perfectly competitive (14) markets were indeed usual in real life. It is this that makes nonsense of most of his pleading. It would invalidate it, even if one were prepared, like the author, to see "education" as just another commodity, the educational system as just another industry, all parents as willing and able to seek and find the right education for their children, and early nineteenth-century social philosophy of *laissez-faire* as relevant to late twentieth-century circumstances.

The book indeed begins with an invitation to discuss the rôle of the state in education in terms of the narrow and negative early nineteenth-century criteria of protection of minors and reduction of crime. And West frequently spoils his case, by overstatement (e.g. he persuasively attacks the disregard of parental wishes through the zoning of schools but then suggests in all seriousness that "the correct response would be to allow the popular school to use all possible improvisations and expedients to carry the increased load in the short-run and all possible assistance to expand in the long run; by the same token, pressure would be applied to see that the less popular schools either shrank or took steps to bring their services up to the standards of the more popular ones", p. 23); by emotional doctrinaire language (the state never simply provides education: it is always guilty of "interference", "incursions", or "invasions" in this field; and it is, apparently, wicked that "modest educational legislation, once established, adopts some momentum of its own and spawns

further legislation", p. 179); by occasional confusion of terms (e.g. between the state and society, p. 70, and elsewhere between education *in toto* and institutionalised education, as well as between education as such and state-provided education); and by sheer wrong-headedness (cf. his comment on the presence of many grocers, tailors, bakers etc. amongst the teachers of private nineteenth-century schools: "the average small schoolboy would to-day no doubt display wonder at the prospect of having such a colourful variety of experienced adults to teach him", p. 167).

For all the interest of his historical analysis and the stimulating provocativeness of his standpoint, Dr West has but proved his case to his own satisfaction. It is doubtful if he could explain away the many historical examples of glaring discrepancies in the provision of educational facilities when left to the market or to voluntary effort. In the last resort, his very serious effort has resulted in a thesis which it is difficult to take seriously. The author seeks to anticipate criticism by saying, p. 230, "some people may accept . . . this book simply as a piece of logic . . . reject it on the grounds of irrelevance . . . [as] hopelessly academic"—quite so, and to anticipate criticism is not to weaken it.

If social and sociological considerations are strangers to Dr West, they receive a proper share of attention in the least technical of the three American books. Professors Harbison and Myers know their economics and value their statistics, but fully perceive the need for a rounder treatment in what is rightly called "a policy-oriented" work. It is an ambitious and brave essay in the applied economics of education, even if it is over-schematic. Fundamentally, the authors set themselves a twofold task. First, by correlating their levels of educational advancement (the term "human resource development" is a bit of American rather than economic jargon) with their levels of general economic development, they classify seventy-five countries into four categories: the underdeveloped, partially developed, semi-advanced, and advanced. Secondly, they analyse the features and problems peculiar to each group, and then map out for it a programme of educational development most appropriate to a satisfactorily fast and even economic growth.

The simplicity of this scheme is attractive but, in the event, not entirely satisfying. Of the two composite indices used, that for educational standards is based on nine sets of data, such as the number of teachers per 10,000 population, numbers of pupils in primary and secondary education as percentages of age-groups 5-14 and 15-19

respectively, etc. The attempt to make the index comprehensive seems right in principle, but when the data cannot be obtained or standardised or weighted, it leads to unrealistic assessments and to anomalies. The semi-advanced class, for instance, lumps together Norway, Italy, India, Mexico and others. Because each of the four categories is heterogeneous, the policy recommendations, however perceptive, in seeking to be relevant to the group in general, are applicable to none of its countries in particular.

The composite index of economic development is technically more sound. In trying, however, to correlate educational and economic development, the authors are correctly but sadly aware that "these quantitative relationships do not establish causal relationships".

This point, of course, is related to the fundamental difficulty of all attempts to assess the returns to education, whether on the macroeconomic or microeconomic scale (i.e. greater national productivity or higher individual earnings). For it is exceedingly difficult to apportion the apparent gains among their many determinants. An educational expansionist may say: "look at the USA in the late nineteenth century: the first country to introduce secondary education for all, and how their economy prospered!" But it is then right to demand that attention be also paid to the country's vast natural resources, the inflow of energetic immigrants, social and legal institutions favourable to fast economic growth—and, for that matter, to the lag between the decreeing and the realisation of secondary education for all. Similarly, for many a financially successful individual, his formal education may have helped him less in life than the physical attributes bestowed by nature, the home-conditioned qualities of ambition and application, or the possession of influential friends. The Oxford economist Balogh (15) condemns as a misconception the view "that the contribution of 'investment in the human factor' can somehow or other be isolated in the process of historical growth, and that numerical magnitudes can be assigned to it which can then be used for extrapolation for policy purposes". And in "the fallacious attempts to calculate the rate of return on capital investment in education for the individual", he even suspects disguised political hopes of protagonists of *laissez-faire* to get education "to pay for itself", e.g. by student loans instead of grants. M. Blaug (16), however, in a recent lengthy paper, repudiates the latter implication, and stoutly defends "the investment approach to human resource development [and] the rate-of-return calculations". To him, the "pure education

effect" on one's future earnings can be satisfactorily isolated by means of multivariate analysis, and, indeed, he feels that we might well succeed in making the whole exercise more valuable by taking into account not merely the crude amount but also the type of education received. Harbison and Myers are optimistic but do not lightly dismiss the technical difficulties; they are, moreover, aware that "the limited economic approach to human resource development distorts the true meaning of the aspirations of modern man and modern societies", and that their own "logical strategies" for economic progress may well be overridden by social institutions and considerations. Theirs is a balanced, cautious, and sensible outlook. Hence, inadvertently perhaps, their book is at least as interesting for the general questions they pose (how to distinguish between building primary schools and providing worthwhile primary education in underdeveloped countries?—how to prevent waste through skills and trades becoming rapidly out-of-date in advanced industrial ones?) as for the specific answers they postulate (17).

The different methods of calculating the economic yield of education are usefully and lucidly explained by Professor Bowen in the first of the three papers comprising his book. A brief discussion of the "simple correlation" approach (i.e. comparisons between countries, or within one country between different points in time), is followed by a sceptical exposition of the "residual factor" method (attributing as much of a country's economic growth as possible to more physical capital, larger manpower etc., and the bulk of the unattributable remainder to educational advances), and examines most thoroughly the "direct returns to education" techniques. An important and often neglected point Bowen notes here is that the claim that even the full *economic* contribution of education is measured by such estimates, is exaggerated. They take into account "in fact only that part of economic activity which passes through the market mechanism". An obvious omission here—as in general calculations of the national income—would therefore be, for instance, the contribution of education to the productivity of housewives. On the other hand, presumably the oft-mentioned frustration of graduate housewives might have to be set against this as one of the less ponderable *social* costs of education—or should it be set against social rather than economic benefits from education, such as less hooliganism or a more thoughtful electorate? But Bowen touches on the problem of social costs and benefits only in so far as these are relevant to a small section of his book (the other two essays in it deal with

aspects of higher education finance in Great Britain with an expertise which makes it clear why he was invited by the Robbins Committee to contribute to Appendix 4 of the Report, on "Assessing the economic contribution of education"). They provide, however, the core of the subject of Professor Weisbrod's volume.

This is a more technical discussion, couched in less accessible language, of benefits from education accruing to persons and places other than the obvious direct recipients of it. If his analysis seems in places scholastic, it is in fact firmly anchored in the results of an empirical study of a Missouri township. Its rigour and completeness are, moreover, likely to appeal to his fellow-economists, and, in view of its important policy implications, it is to be hoped that many educationists, too, will not find his essay too esoteric to read and digest.

For, on balance, education is more likely to gain than to lose from the attention paid to it by economists. A mean attitude to public expenditure on education stretched from the Revised Code of the 1860s through the "Geddes Axe" of the 1920s to the avowed intention of the Minister of Education as recently as 1952 to cut expenditure by 5%. It is arguable that it is partly because economists have been demonstrating lately that, over and above its social and cultural value, education contributes weightily to our material prosperity, that this attitude is now dead. The mutual distrust of educationists and economists is, however, not yet dead. As P. H. Coombs (18) recently pointed out: "Educators . . . are deeply interested in people as *individuals*, not simply as manpower statistics . . . some . . . bristle with rage when such terms as 'efficiency', 'waste' and 'productivity' are applied to education . . . to the horror of economists . . . they are inclined to assess their output mainly by the inputs [e.g.] the pupil-teacher ratio, expenditures per pupil . . . rather than by the performance of the product." There are signs, however, that, as the need to economise their resources is becoming increasingly evident, and as more economists adopt a broad and positive view of education, educationists are coming to regard them as valuable allies rather than as dangerous intruders.

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LEARNING BY DISCOVERY: ITS RELATION TO SCIENCE TEACHING

by JO ANNE BIBERGALL

Lincoln Jr. High School, Mt. Prospect, Ill.

I. INTRODUCTION

THE following definition of "discovery learning", which will be used in this article, is a compilation of attempts to clarify the term by various authors (Kersh, 1964; Kersh and Wittrock, 1962; Bruner, 1961; Taba, 1963). Discovery learning is "all goal-directed behaviour in which the learner completes, or attempts to complete, a learning task through using his own mental abilities to organise and utilise the content of the task without assistance from a teacher".

It should be pointed out that several types of discovery learning are recognised. These subgroups, with their simplified definitions, are as follows (these are again a compilation from several authors: Kersh, 1958, 1962A, 1964; Kersh and Wittrock, 1962; Gagne and Brown, 1961; Kittell, 1957; Wittrock, 1963):

(1) Pure discovery: techniques involving no direct assistance, other than encouragement, by a teacher.

(2) Guided discovery: techniques involving minimal to moderate aid by a teacher.

(3) Expository learning: highly directed learning involving maximal help by a teacher and usually little or no actual discovery by the student.

In science teaching there is no longer any question as to whether or not we should use the method of teaching by discovery. Most researchers and teachers are aware that it definitely has its uses. The question is rather, as Ausubel (1964) puts it, under what circumstances and for what purposes should we utilise this technique in one of its forms? Among the "pro and con" claims made regarding these purposes and situations are the following:

(1) It enables the student to develop an interest in the task; he is motivated (Kersh, 1962).

(2) The student is more likely to remember the material under consideration.

(3) There is greater transfer; the student learns techniques for discovering new generalisations (Kersh, 1964).

(4) The only time learning is meaningful and well understood is through discovery; all problem-solving and laboratory experiences are meaningful (Ausubel, 1964).

(5) The method is best used when the learner is at the developmental level of being dependent on concrete-empirical props.

(6) If the method is used exclusively the student does not learn enough subject matter and also the time-cost involved in over-using the method is prohibitive (Ausubel, 1962A, 1964).

(7) If a part of the technique is to have the student verbalise his discovery, more harm than good is done (Hendrix, 1961).

2. MOTIVATION

There is widespread agreement that one of the main advantages of the discovery method of teaching is motivation of the pupil. It is further agreed that as a solution to the problem of motivating the child the discovery technique has no rival in methods of teaching (Hendrix, 1961; Kersh, 1958, 1962A, 1964; Kersh and Wittrock, 1962; Bruner, 1961; Keislar, 1962). Pupils will not develop curiosity, a questioning attitude or be motivated simply by listening to lectures, seeing demonstrations, completing long assignments, or having their questions answered with "pat" answers (see e.g. Keislar, 1962). As the discovery method promotes none of these but, for the most part, just the opposite, it can be motivating if used correctly.

Several hypotheses have been offered as to the exact reason why this method is so motivating in that the pupil will continue to work on similar or related problems long after the primary discovery task is over. Keislar (1962) here expresses the opinion that if the teacher or another extrinsic mechanism is the reinforcer, the pupil will tend to learn "only what the teacher wants". He states that intrinsic reinforcers, which are not directly related to teacher intervention, such as formulating and testing one's own hypothesis, are better motivators and are exactly what the discovery method proposes. Bruner (1961) is in agreement, adding that intrinsic reinforcers tend to lead one away from control by environmental rewards and punishment. He implies that motivators which have personal meaning are better

as they are more meaningful to the student. Kersh (1958) clarifies this matter still further by indicating the actual part of the self which is involved. The motivating power centres around the ego involvement of the person. As one of the primary concerns of the self is ego maintainance and enhancement, what better motivator could there be? Taba (1963) offers slightly different reasoning as to the inherent motivation involved in discovery. Since the latter is an active process it probably mobilises the competency motive of the individual as a drive for continued learning. It thus frees the learning act from immediate stimulus control and in place establishes the cognitive control of the person. This is somewhat similar to Kersh and Bruner's suggestions in that in all the hypotheses the individual himself becomes emotionally and intellectually involved.

Kersh, in a later paper (1962) adds an interesting experimentally confirmed qualifier to the whole concept that discovery is motivating by saying that unless the person has almost no direction (as in pure discovery) and expends intense effort for fifteen minutes or more motivation fails to appear to any great extent. This would seem to indicate that motivation is not only dependent upon ego involvement but also upon the time spent and the type of discovery technique utilised. Kersh and Wittrock (1962) have done some work in this latter area and found that guided discovery is the more motivating of the three types. The reason appears to be that the reinforcement given by a teacher in the form of encouragement and support (even if the pupil does not discover the correct answer) motivates the child to continue working and he in turn becomes more motivated. The teacher apparently has become involved in his ego enhancement.

3. MEMORISING

Discovery not only promotes motivation but also appears to increase the ability to remember the material under consideration. Here again Bruner (1961) relates this to ego involvement. If (as one does in discovery) one organises the information somehow so as to reduce the complexity by imbedding it in one's cognitive structure and, thus, making it more personally meaningful, the material becomes more accessible. It seems to be a matter of how the material is placed in the memory that determines its ability to be recalled later.

Kersh's (1964) work in this area seems to indicate that remembering is closely related to the problem of motivation. He cites experimental evidence that a group will learn more initially when they do not have to use discovery techniques. However, a group which

does use discovery techniques, even if they fail to discover, appear to have learned something after all and have retained much more of the material when retested a month or six weeks later. The former group when retested was quite forgetful. He relates this to the fact that the discovery group was motivated to continue independent work after the experiment.

In an earlier paper Kersh (1962) expressed the idea that attempts to gain understanding after one learns a rule (he is referring to expository learning as in discovery one supposedly understands and gains insights as one moves along) may prove to have an inhibitory effect upon recall. No-one as yet has followed up this possibility. There is also a lack of direct evidence regarding what type of discovery method would promote the most recall.

4. TRANSFER

Transfer seems also to be related to motivation and to recall. The more one is motivated and the better the recall, the more likely there will be transfer to other learning situations (Kersh, 1958, 1962A). Particularly as a result of the increased motivation to continue independent study, the learner comes to rely on himself and can then relate the learning to his own experiences and will develop a searching attitude. This is the type of learning which is easily transferable. Actual discovery occurs when the learner can transform his information, can see the relation of facts which he has, can understand the causes and can relate to past knowledge (Taba, 1963). In effect, the learner has discovered when he can transfer his knowledge. One could define the actual moment of discovery in terms of transfer. Discovery techniques and ease of transfer then go hand in hand.

Wittrock (1963) gives some further insights into this relationship. If one verbalises the discovery, then transfer is enhanced because alternative responses which produce negative transfer are eliminated and alternative responses which produce positive transfer are included. He continues that not putting labels on concepts when the learner has a background to make the labels meaningful is attempted by some to increase transfer, but in reality it probably reduces it and simply wastes time. This appears not to have been experimentally tested and obviously should be. There is current disagreement over this matter.

There appears to be one rather formidable difficulty regarding transfer and discovery. This revolves around the belief that one can gain all the attributes of discovery in all subjects, particularly moti-

vation and understanding of the material taught, if one teaches discovery techniques *per se* removed from all subject matter. Ausubel (1964, p. 298) states:

The sequential growth of knowledge can only be enhanced within the context of a specific discipline. Grand strategies of discovery do not seem to be transferable across disciplinary lines.

Some scepticism would seem to be laudable here as he states as his only proof of the above that this is confirmed by "countless studies" and the "laughable" errors of scholars outside their respective fields. He fails, however, to cite even one reference to these "countless studies" either in his text or bibliography. Also, he himself appears not to be convinced of this matter as shown in his words "do not seem to be". He further adds without any proof (p. 299) that problem-solving ability (which he seems to use synonymously with the ability to do well in using discovery to gain understanding) is transferable to other problem areas in the same discipline.

Ausubel's idea has many implications for teaching and should be further investigated. One short point may be added here, Kersh (1964), who is extremely interested in discovery, feels that directed (or expository) learning is best for studying specific subject matter aspects. Thus, he too seems to imply that transfer is negligible or of little importance across subject matter lines when one is using discovery.

5. UNDERSTANDING

When we consider whether only discovery learning can promote understanding and an attainment of the meaning behind material, only one author, Ausubel, can be found who is prolific on the subject. This is most unfortunate. Taba (1963), in a passing note, agrees with Ausubel (1961, 1962A, 1964) that it is a mistake to assume that all problem-solving, discovery techniques and experiences are meaningful and that the only time learning is meaningful is through discovering something for one's self.

In his discussion Ausubel (1961) distinguishes three basic types of learning: rote, meaningful reception and discovery. In rote learning the learner simply "internalises" the material. In meaningful reception learning he integrates the material into his existing cognitive structure ("a given individual's organisation of knowledge") through expository teaching techniques rather than simply "internalising" it. Finally, in discovery learning the pupil integrates the material

into his cognitive structure by discovering it. Rote, Ausubel says, is obviously bad as ideas cannot be meaningfully understood unless they are reconciled with existing concepts and translated into a personal frame of reference; unless they can be integrated into one's cognitive structure. When only understanding material is desired there is little difference between the remaining two types of learning. Either type can be made rote or meaningful (1961, 1962A, 1964). Expository teaching techniques can make material very meaningful as long as the learner is not obliged to accept the material on blind faith (1962A) and the new material is logically relatable to former knowledge (1961).

Ausubel (1964) goes to great length to explain how discovery techniques can amount to nothing more than rote learning when used improperly. Laboratory experiments can be performed in "cook-book" fashion without any meaning. Pupils can find it quite easy to discover answers without really understanding when discovery techniques are not correctly used. They can memorise "type problems" and procedures for working with and manipulating symbols. Thus, not only the material must be made meaningful but so must the operations used to discover the answers. A further mistake, besides having students memorise "type problems" and procedures, is to encourage them to mimic the minutest steps of the scientific method. This method was not set up to be rigidly followed but is meant to be quite flexible. In fact if one observes scientists, one finds that they seldom, if ever, make an effort to follow the method very precisely.

Experience can quickly show the validity of many of the ideas presented above, but they should not be taken completely for granted until experimental evidence can substantiate them.

6. LEVELS OF THINKING

Ausubel (1962A, 1962B, 1964) is again the only author discussing another topic of great importance to any consideration of the value of discovery learning in teaching science. He finds discovery learning only worthwhile "when the learner is in the concrete stage of logical operations and is dependent on concrete-empirical props and on a preliminary phase of intuitive, subverbal insight for the learning of complex abstractions" (Ausubel, 1962A). The child at this time would be generally under twelve years old and in the junior school. Even then, however, discovery is not absolutely necessary, since the only necessary learning condition at this age is the availability of concrete-empirical experience. Thus, one could use verbalisations

(expositional learning) accompanied by props. Only when difficult and unfamiliar ideas are to be presented is discovery very worthwhile.

Beyond these school years students can handle abstractions quite well (1964). They are then in the abstract stage of cognitive development and can "form most new concepts and learn most new propositions by directly grasping higher-order relationships between abstractions" (1962B). Ausubel does not suggest that one should not use discovery or that it is completely inappropriate for older age levels. He merely attempts to remove the current conception that discovery learning is the only way to teach, and indicates that it can be worthwhile under certain conditions and for certain purposes. With older students, two of these purposes are for teaching a different new discipline (1962A) and for new subject matter (1964) as at these times more mature students revert to a relatively concrete level of learning. Hendrix (1961) agrees with him on these two aspects.

7. TIME AND COST

The time-cost of discovery learning is an important consideration for any modern educational system.

Ausubel, one of the very few authors who has attacked discovery on many counts, argues that if one had to discover everything in order for it to be meaningful, one would never get beyond the rudiments of any one subject. Other factors which further increase the time-cost are that children, being too subjective, tend to jump to conclusions, generalise with only very limited experience, consider the aspects of a problem as separate and unrelated, and interpret in terms of prevailing folklore.

The time involved in teaching mainly by discovery is enormous. Currently most of what we meaningfully understand was in fact discovered by others and merely presented to us meaningfully by a method other than discovery. This was far less time consuming than if we had to rediscover everything we know. The most important reason for not using the discovery method exclusively is the danger that pupils will not learn enough of the subject matter (Ausubel, 1962A).

8. VERBALISATION

An interesting controversy has been waged concerning verbalisation and the discovery method. It appears that as yet no conclusions have been drawn or decisions made on this matter. Hendrix (1961) is of the opinion that a pupil should not verbalise his discovery very

soon after it has been achieved unless he is very well versed in language. The teacher should look for behaviour or responses other than language to indicate that the pupil has made the discovery. He should not ask the child to explain his answer or to formulate a principle, rule or generalisation. There are several dangers for the child involved in making premature verbalisations. These include the following:

(1) Trying to verbalise becomes a guessing game in which the child is merely trying to discover what the teacher wants him to say and is not really giving his true impressions.

(2) Trying to verbalise too quickly can lead to nothing more than an exercise in semantics.

(3) Asking the child to state his discovery is to some extent belittling his exhilarating accomplishment at the actual discovery. He is forced to replace his excitement with the long tiresome task of verbalising.

(4) The child is further damaged in this process in that, if the teacher wants the precise generalisation with all of its qualifiers, he will most likely have to go beyond the child's level of maturity and knowledge and force him to verbalise and learn concepts far too advanced for his years.

Hendrix concludes that pure discovery, which should not call for these verbalisations, is far superior as a method of teaching to the inductive method (or guided discovery) which does call for them. Several authors disagree although none does so very clearly or precisely. Ausubel (1964) states that in discovery, verbalising is extremely important as it makes the concept "sharper, clearer, more precise, more inclusive, more transferable . . .". Ausubel does not, however, state the mechanics involved. Wittrock (1963) unfortunately is not any more precise as to why verbalisation is the best technique. According to him, not putting labels on concepts when the learners have a background to make the labels meaningful probably reduces transfer and wastes time. The learner should state exactly what he has found in order to make it more meaningful. Taba (1963) is in agreement with the latter two authors, her reason being that the pupils must show some operational evidence of their understanding before they can even begin to formulate the principle: since the experiment was undertaken in the first place to discover the principle, it would make no sense not to attempt to verbalise the discovery.

We need more experimental evidence to confirm one of the above

hypotheses. It would appear that verbalising depends to a great extent on developmental maturity. To Hendrix the stage when verbalisation is inappropriate is the time when the child is in the concrete stage of logical operations. However, this would perhaps be the best time to verbalise, to put the principle in more concrete terms rather than to leave the child to his own abstractions.

9. CONCLUSION

As stated at the beginning of this article, it is not a matter of whether or not one should use discovery learning. One should use such techniques when they are applicable, and it is agreed that they are applicable to science teaching. It remains a matter of which of the three types of discovery learning should be used, and in what circumstances.

Pure discovery is most applicable in the following situations: (i) when high motivation is desired, (ii) for transfer, (iii) for recall, (iv) when teaching about discovery, *per se*, and (v) to promote nonverbal awareness. On the other hand, the expositional technique would be most profitable in the following cases: (i) for specific matter aspects, (ii) when the student is at the abstract level of development, and (iii) for quick initial learning. Guided discovery seems to offer a happy medium between the two other types as some of the efficiency of expositional learning is maintained along with the benefits of the pure discovery process. It can be well adapted to most situations. Among the most beneficial times are: (i) for teaching the organisational framework of a subject, (ii) when the learner is unsophisticated in a subject, (iii) when the learner appears to show no motivation nor is there promise that he will in the future, (iv) for establishing the relationship between new and previous learning, and (v) for all the same circumstances as pure discovery and expositional learning.

It should be remembered that regardless of the situation, there should be a balance between discovery learning, or learning in depth, and expositional learning, or learning for scope. No course in science is complete without an integration of the two. It is perhaps most important to point out that the kind of learning theory that may work for one teacher may not work for another. This is especially true in the case of the discovery technique, which is clearly an art: not all people, possibly not most, are adept at being artists.

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BOOK NOTICES

J. W. PATRICK CREBER, *Sense and Sensitivity: The Philosophy and Practice of English Teaching* (University of London Press, 1966, 30s.).

MR CREBER was head of the English department of Churchfields Comprehensive School, West Bromwich, for a number of years and is now a lecturer in Education at Manchester University. His book, *Sense and Sensitivity*, fills me with gratitude and admiration. It is a splendid work—second to none on teaching, through English, all ability levels in the secondary school—wise, eloquent, humane and packed with shrewd observation and practical advice. I wish it were possible to compel all teachers, particularly all English teachers, and more particularly still all senior English teachers and examiners not only to read it but to suck it dry.

Mr Creber writes with all the deeply involved and passionate concern of David Holbrook to help children to a fuller and happier life by discovering a richer language for understanding themselves and the things that are near and real and important to them but without Holbrook's pessimism about so many aspects of contemporary culture. His ideals are nourished and his literary insights sharpened, like Professor William Walsh's, by an intimate acquaintance with the minds of Coleridge, Wordsworth, Keats, Hopkins, Lawrence, Eliot and Leavis but he avoids the concealed narcissism and élitism involved in writing as if people with a literary education are necessarily more admirable human beings than the rest of mankind. Creative writing and empathetic response are, for him, essentially part of one process and if the ultimate aim is an extension of moral perceptiveness, the intolerable wrestle with words and meanings for expressing one's own experience has as important a part to play as imaginative projection into the minds and circumstances of others through literature; it breeds a constant humility.

Predictably, then, Mr Creber approaches what his pupils are stimulated to say and write with respect and close attention. This is the basic material of English lessons rather than the contents of books of exercises or even a corpus of literary texts. Pupils can be, as he says, "poets and novelists, *in posse if not in esse*". This is not to say that he displays adolescent masterpieces by highly intelligent children for the reader's admiration. Quite the contrary: most of his quotations show average or even backward children in the very process of growing up through language, learning to observe things with eyes "greatly open", learning to balance the self-consciousness of adolescence with awareness of other people's feelings,

developing a sense of the obligation to communicate and therefore to respect the conventions of spelling, punctuation and grammar.

Mr Creber writes, "In a book that attempts to present English as a unity, and to demonstrate the interdependence of all its aspects, there is something anomalous about having separate chapters. These in no sense represent separate topics but rather different angles from which to view the subject." He manages very well, it seems to me, the difficult task of structuring his book without fragmenting it. The first part, of four chapters, is called *The Imaginative Faculty* and the second part, of six chapters, *The Critical Faculty*, and he is constantly illuminating about how he gets children of very varied ability absorbed in speaking, listening, acting, reading, writing, judging, arguing and thinking. The second part does, however, raise one or two important questions which need fuller discussion. In Chapter 8 on *Reading and Comprehension*, for instance, he talks about introducing third or fourth year children to "the concept of the writer's aim as determining our evaluation of what he has written" and he calls this "the basic critical principle". Of course it is absurd to blame a chrysanthemum for not being a rose, and this must be understood, but I should want to quote in this context D. W. Harding's wise words that, "What matters for the social relation between the author and reader, is the author's satisfaction in his work, not his intention. What he intended to write at any moment prior to the arrival of the words is not of crucial importance; . . . when we contemplate the work of art we share in the author's satisfaction that it was as it was and not otherwise."

Again, in Chapter 9 on *Building a Resistance*, when he talks about "building a healthy cynicism", this seems to me a contradiction in terms and "scepticism" which Santayana called "the chastity of the intellect" might be a happier word. But in this section he also seems to me to underestimate the importance of the teacher first learning himself and then teaching some straight factual information about the organisation, techniques, limitations and possibilities of the mass media—about the economics of advertising for instance. Mr Creber's attitudes are *not* half-baked, superior or condescending (the faults of so much of this kind of teaching), indeed he rightly emphasises the importance of accentuating the positive and eliminating the negative. But however determined one is to behave with self-abnegation and tact, to discover values *with* children and never impose values *on* them, it is very difficult to do this fairly if either teacher or pupils are basically *uninformed* about the mass media.

It would be a mistake to see these observations as fault finding; it is one more mark of Mr Creber's success that one occasionally wants to argue with him. There is evidence in every page that he has thought out with *rigorous persistence the theory underlying his methods and he has compressed a great deal of it into a very solid 250 pages. Inevitably one would want to make some additions to his bibliography—to reciprocate his own generosity in leading the reader to his own favourite oases. The only*

general improvement I could suggest would be the incorporation of many of the numerous footnotes into the text itself; many are too good to miss and strengthen the argument. His Parkinsonian law, for instance, about the damnable dullness of Grammar school classrooms "that the dreariness of the décor is in direct proportion to the academic pretensions of the establishment" is more than a pleasant aside: it is a profoundly revealing remark about the common hostility of a scholarly ethos to literature and the arts.

M. K. PAFFARD

LAURENCE DAVIES, *Liberal Studies and Higher Technology* (University of Wales Press, 1965, 45s.).

THIS is a long but essentially a very slight book. It contains an account of a survey carried out at the Welsh College of Advanced Technology during 1962-63 on the attitudes of 215 students and 78 staff to liberal studies. The results are quite unexceptional: recorded in a short article, the investigation would have taken its modest but proper place in the records. In a book of 345 pages, heralded as it is by an elaborate introduction suggesting that important and "urgently needed" information is about to be revealed, it cannot escape severe criticism.

The Introduction is followed by three introductory chapters: other research is discussed in great detail: the well known arguments for widening educational curricula are marshalled: everyone from Aristotle to Leavis is quoted and Brave New World and 1984 rear their horrifying heads once again.

The author's bias becomes clear at an early stage both in his evaluations and his omissions. Universities and other colleges may arrange General courses for all specialists but Mr Davies clearly believes in the need to save the technologists, especially those in C.A.T.s, by means of "Liberal" studies.

The reporting of the actual investigation is deplorable. A "special piece of experimental research" turns out to be a 15 item questionnaire called "The Staff Opinion Survey" which was completed by 72 lecturers. 92% (66) answered "Yes" to the question "Do you approve of the idea of liberal studies?" and 28% (20) answered "No" to "Are examinations desirable?" The value of this kind of information or the use made of it in this particular college is not discussed but the propagandist intentions of the author are not concealed. The work was not based on any clearly stated hypothesis but he says of one item that he was concerned to "win approval" for the idea of liberal studies and agrees that the "triumph of utilitarianism is perhaps inevitable". He says there is "no doubt that liberal studies teachers are sometimes made to feel unimportant" but he has to report—somewhat grudgingly I felt—that "those critics who continue to maintain that technological students show no interests in anything but technology are effectively rebutted by the statistics we have derived". He does not

seem to share his students' main interest which turns out to be—not surprisingly—science, but is “reassured” to find that they also enjoy music (of all kinds), literature, politics, social studies, religion, the arts. . . .

In addition to two interest questionnaires and a specially prepared liberal studies attitude scale, the students also completed a non-verbal and a verbal intelligence test and the Maudsley Personality Inventory. The statistics are set out in the minutest arithmetical detail in over 90 pages of appendices but detective work on the text was necessary to discover such essentials as the precise set of Raven's Matrices used or whether the verbal test results had been compared with the norms for Science graduates as distinct from Arts. They had not.

The writer is “tempted” to read far more into the results than, in my opinion, they can bear. On the intelligence testing he records the extraordinary conclusion “that engineers tend to do better . . . than applied scientists”. The figures for such a special sample are of course meaningless without comparative ones from other colleges and Universities, and in the absence of any knowledge of the differential attractions of the Welsh C.A.T. for engineers, as distinct from scientists, in the year 1962.

The book ends with an ambitious syllabus and reading list for a liberal studies programme which, in contrast to the weighted arguments in the first chapter, includes as one of the electives the “History and Philosophy of Science and Technology”.

ETHEL VENABLES

V. HORNER, *Music Education—The background of Research and Opinion* (Australian Council for Educational Research, 1965, \$4.50).

THE author's purpose in this work is to survey, collate and evaluate research studies and controlled investigations in the field of musical education in the English speaking world.

Following a survey of the literature relating to curriculum planning, the author considers in detail three aspects of the music curriculum: appreciation, performing and creating. The literature devoted to the nature of musical abilities and to measurement and such topics as general learning theory, programmed instruction, team teaching, tachistoscopic techniques and teacher training also receive attention.

Most of the research into musical education has been carried out in the United States and frequent reference is made to the writings of Seashore, Mursell, Lundin and Farnsworth as well as to the papers published in the *Journal of Research in Music Education*, founded in 1953 by the Music Educators' National Conference. The Conference established the Music Educators' Research Council in 1950 and has published a number of bibliographies of research studies in musical education.

Reference is also made to the writings of such leading British musical educationists as Wing, in the field of measurement and evaluation, and Mainwaring, who studied the cognitive processes in musical education and

applied the psychological principles of concept development to the field of music.

It is evident from Mr Horner's survey, however, that there are many serious gaps in the research literature and that concentrated research effort is needed in several important areas. Few psychological studies have been made of the application of general learning theory to the field of musical education and of the sequential development of musical ability and responsiveness to music. Nor has the subject of musical appreciation received adequate treatment. Although Meyer has written valuable studies of the establishment of value criteria and Farnsworth has researched into the development of musical tastes, little consideration has been given to the applicability to the field of musical education of methods and techniques used in other fields of aesthetics. A number of attempts have been made to devise measures of appreciation and taste but they have poor validity and reliability. Other subjects requiring further investigation are musical literacy and creativity, the learning processes involved in acquiring instrumental techniques and the relevance to the education of handicapped children of the research carried out in recent years into the part music can play in psycho-therapeutic practice.

Much that has been written on the subject of musical education is speculative and conjectural, based upon cumulative practical experience rather than systematic and controlled research. Certain important subjects, it is true, do not lend themselves easily to scientific scrutiny and the philosopher can frequently make a more valuable contribution than the psychologist. However, Mr Horner maintains that the empirical approach lacks the objectivity, validity and reliability of research procedures: "objective data derived from more careful and systematic investigation are essential for the solution of the many problems facing the music educator". In recent years a number of valuable investigations have been carried out, employing correlation and factorial analysis techniques, action research and controlled laboratory technique.

Researchers into musical education have been considerably handicapped by the absence of an urgently needed delineation of objectives and by the diversity of definitions of basic musical terminology. Thus differing views upon the complex nature of musical ability are revealed in the studies which have been made of measurement and evaluation: in the main, British investigations have been based on the assumption that there is a general musical ability factor and a number of group factors, whereas most American research workers have subscribed to the multifactor view that musical ability comprises several relatively independent variables. Consequently, although the principles of test validity and reliability are now being applied more stringently to tests of musical ability, educationists remain reluctant to rely on such tests for diagnostic purposes.

Mr Horner has performed a valuable service in writing this comprehensive, well-documented survey of research literature and it is to be

hoped that it will encourage musicians to study research techniques and to work in close conjunction with other educationists in the many areas where research is so urgently needed.

J. B. BROCKLEHURST

J. A. ALLEN, *Energy Changes in Chemistry* (Blackie and Son Ltd., pp. 152, 7s. 6d. (paperback) or 13s. 6d. (boards)).

THE stimulus for this book came initially from the annual Summer Schools of Chemistry Teachers conducted in recent years by the University of New South Wales and as such may be warmly recommended to all those teachers of Chemistry who face a personal problem of self re-education arising from recent changes in chemistry syllabuses. Professor Allen's book does not purport to be an elementary text and some previous knowledge of equilibria, kinetics and thermochemistry of about "A" level standard is required. On the other hand, the mathematical demands made upon the reader are quite modest.

There are eight chapters and the Laws of Thermodynamics do not appear until the end of the third, by which time the concepts of enthalpy, free energy and entropy have been explained lucidly and used operationally in a study of equilibria spread over the first three chapters. Afterwards, the reader is taken through energy changes in solution, energy relationships in the Periodic Classification, chemical bonding, catalysis and rates of reactions in that order. Problems (with answers) and data are supplied both in the text and at the end of the book.

One minor criticism is that important statements, excellent and properly placed in themselves, tend to lose their impact upon the reader by being printed in small type. Otherwise this is a very good book; concise in its treatment of the subject, practical in its approach and, last but not least, very easy to read.

C. V. PLATTS

Health Education, Sex Education and Education for Home and Family Life (International Studies in Education, UNESCO Institute for Education, Hamburg, 1965, pp. 118, 11s.).

THIS is the report of an expert committee which met in Hamburg in 1964 to discuss the problems of Health Education, Sex Education and Education for Home and Family Life with special reference to the 14-16 year age-group and to seek guide lines along which such problems might be solved.

The guide lines are given in the first three chapters of the report (pp. 13-39) and they represent the deliberations on the contributions of the various members of the committee which are reproduced later in the report (pp. 41-92). The need for education in these three areas is emphasised but it is clearly pointed out that with the diversity of tradition, religion and outlook between the interested nations there can be no universal

solution. There is, however, considerable agreement on what is to be taught, how it might be taught and by whom.

Health education, and all that that implies, is not merely the provision of information—it is a way of life. It begins in the home and is continued in the schools. Where the home fails to face up to its responsibilities an extra burden is thrown on the schools. This is an excellent report, it should be made available for all teachers and particularly teachers in training to read.

J. N. OLIVER

S. JACKSON, *Special Education in England and Wales* (O.U.P., 1966, pp. 147, 13s. 6d.).

THE incidence of handicap amongst children is probably much higher than is realised by those not actually working in the field of special education. Fortunately many of the children are capable of profiting from education which is geared to their own particular handicap and the 1944 Education Act made it quite clear that it was the duty of the local education authorities to provide such education.

In his book Mr Jackson describes the 10 official categories of handicap. He introduces each by means of actual case studies which lend interest and meaning to the text that follows. He indicates the alternative methods of educating the children and discusses their relative merits in relation to the children concerned. He also indicates the type of special training that is required by the teachers of handicapped children. There are some children who cannot be educated satisfactorily even in special schools and a section is devoted to these problems.

Mr Jackson might be accused of having attempted to cover too much in one volume and, therefore, of not going deep enough into any one handicap, but this is not a specialist treatise, it is a brief description of the problems of handicapped children and methods whereby these might be solved. It contains a wealth of information and can be strongly recommended as a text for training college students and others who intend to teach.

J. N. OLIVER

P. J. HITCHMAN, *Examining Oral English in Schools*.

IF anyone is to examine Oral English in schools, Dr Hitchman is the man to do it. He has indeed gone into the business exhaustively. His account of the mental processes of interviewer and candidate is well-supported by the findings of psychologists. His material for an oral examination and scheme for its conduct are sensible and helpful. I hope, therefore, that he will forgive me for coming away with the impression that, in view of the immensely valuable effect which oral testing must have in schools, it would be far better to abandon the idea of a scientific assessment of the verbal ability of children ("our ideal is an identity of judgment between any

number of assessors judging the same set of candidates") in favour of a generally valuable estimate which yet admits to the possibility of human error. And puts spoken English on the syllabus. First things first. In one test, a candidate can't read a poem of his own choice, because the method is "statistically unsound".

Not that the book is in any way reticent about the difficulties involved in the testing of oral expression.

"By 'test reliability' in connexion with spoken English tests, we mean reliability of gradings or ratings made by competent assessors adequately briefed to administer a properly constructed test. We are dealing with the degree of consistency of agreement between assessors."

The interviewer must have the social skill of establishing contact and communication, initiating a discussion, trying another if that fails, putting the right question and absorbing what is being said. At the same time he must be noticing whether the candidate has established sympathetic rapport by means of his manner of speech and style of delivery. The content and disposal of what is being said must be appraised, the verbal expression. The candidate's voice must be criticised for pitch, freedom from tension, articulation; the body, hands and feet must be watched to see that they too are taking part. Marks must be made under several headings, and in fifteen minutes another candidate will appear. Some examiner, that.

Dr Hitchman tells us that oral English tests are just about as reliable as written English tests. I wonder if this takes into account the more recent developments in English testing? He mentions marking by several hands, but not the objective type assessment of the "Use of English" paper. Three teachers may assess an essay more fairly than one. When three assessors judge the same oral candidate (if the Board can afford three) they may very well inhibit the candidate. Probably they approach their task with such a different "set" (actor's? English teacher's? Drama trainee's?) as to be asking for totally different things.

A pupil who writes inadequately at school seldom goes home and writes well. It is not at all unlikely that a pupil who speaks inadequately in front of three judges goes home or into the playground and does very much better.

The form of oral examination mentioned is of the prose-verse reading, prepared talk, conversation type. The first has no element of spontaneous utterance in it, the second cannot really prevent a candidate from reciting a speech he has learned by heart (the degree of subtlety is up to him), and the third, for all the elaborate provision made, would seem to be so artificial as to admit of serious defects.

Dr Hitchman lists three "internal tests for classroom use" and these seem to me useful and reliable, preferable to more formal oral examinations. In a footnote, he suggests a record card for speech, kept throughout a pupil's school career. A better idea still. It would record a pupil's strengths and weaknesses in oral English and act as a chart of progress over several

years—surely a useful, continuous account and testimonial at the end of school life.

There remains one important aspect of examining oral English, and that is the most susceptible of objective examination—listening. Dr Hitchman gives it some attention, but not much.

D. ATKINSON

RACHEL POWELL, *Possibilities for Local Radio* (Centre for Contemporary Cultural Studies, University of Birmingham, Occasional Paper, No. 1, 5s.).

PIRATE radio stations proliferate. A change of Government might well mean local commercial radio stations as part of the spoils of office. This first paper from the Centre is therefore timely; in its facts and figures it gives us a basis from which we can argue. In its proposals for local radio, Rachel Powell is notably positive, as opposed to politicians like David Gibson Watt, M.P., who advised commercial operators to learn from "the regional stations, both on television and broadcasting". The BBC sound of all three? The ITV companies? Radio Caroline? Or perhaps a combination of all three? But Mr Watt went on to talk about Caroline. (Parliamentary debate, May 1965.)

The advocates of commercial radio need to placate informed opinion, promise large, prosperous audiences to advertisers and put the prospect of more pop before the "teenage market". This is the place of really local material if the advertisers have their way: "If the station broadcast more than 45 minutes of local material in every eight hours, it would not be attractive to advertisers and hence it would not be a viable proposition" (Hansard, 13th May 1965). Pop records, syndicated entertainment, a very little local news and the advertisements which controlled the enterprise, would make up the programme.

Rachel Powell's proposals are summed up in "The idea is to improve, if we can, the links between different parts of the community". She sees the station as a centre, and if I find her notion of a regular programme of local entertainment emanating from it, somewhat lowering to the spirits, there is nothing wrong with the sense of community which prompts it. The exchange of ideas between schools and teachers offering an optional syllabus to the Examining Boards is a splendid idea; adult education classes could similarly be provided for the Centre. Local churches should have their part and Rachel Powell rightly points out that political discussions from the centre could be real discussion, not dedicated to "personalities", lovable reactionaries and the like. News and forward information would be important, and local writers and musicians could be encouraged by groups listening regularly and meeting to discuss. A local radio should give information or employment prospects in the area, and relative food prices. In this, regional radio could be really useful and independent. Finally, there is the suggestion for action. The Isle of Man has com-

mercial radio. Why not a Channel Islands experiment by the BBC now, before lack of action in itself constitutes action?

D. ATKINSON

M. L. KELLMER PRINGLE (ed.), *Investment in Children* (Longmans, 1966, 12s. 6d.).

THIS is a book to be highly recommended to all concerned with child welfare and education. It is a symposium of papers given at the first Conference held by the National Bureau for Co-operation in Child Care. It is more satisfactory than many such compilations in that the speakers have extended and re-cast their spoken contributions into a mould more fitting publication than is often the case.

The symposium is edited by Dr Kellmer Pringle, Director of the Bureau, and has contributions from a number of leading specialists in different fields. Subjects covered are: The Rôle of Education, The Role of Paediatrics, The Role of Social Work and The Rôle of Psychiatry. There are also two chapters by Dr Pringle in which she draws together the different strands of the discussion and presents further views on the promotion of the welfare of children.

In the first contribution Dr Wall deals with a key issue for education which is often dodged. Education seeks to change children and yet the better able we are to do this effectively the louder the protests against "manipulation" and "brain washing" are likely to be. Dr Wall argues that we should do our best to use our knowledge of child psychology in "deliberately and systematically shaping human evolution". The school is central to this concept. Other social services seek, in the main, to repair damage. The school seeks to improve the normal. The systematic use of the services which underlie child care and education can help the school to fulfil its task effectively.

Similar attitudes inform other contributions and it is refreshing to read Professor Mays arguing that social scientists have a responsibility to help control and to induce planned social change instead of making claims to neutrality which "... will be seen for what they are, cowardly evasions of responsibility".

These references to specific papers give an indication of the approach of other contributions. As Dr Pringle says, there is some justification for cautious optimism in the field. This may well be because we are beginning to emerge from the airy-fairy stage of child rearing theory where "... many different specialists used the full weight of their professional authority to back up private prejudices concerning what is good and what is bad in the care of young children".

This book draws on many sources which give us objective evidence about the problems of child care and education. It also shows that we are not so utterly at the mercy of heredity and natural forces as was once supposed. And many of the contributions show how the positive rôle of

the various professions concerned with child welfare can aspire not only to repair the "damaged" but improve the "normal".

E. STONES

D. E. M. GARDNER, *Experiment and Tradition in Primary Schools* (Methuen, 1966, pp. 211, 26s. 6d.).

THE term experimental is used in this book to describe schools where teachers are providing for the interests of each individual child or group of children. Traditional schools are defined as those where teachers closely follow an agreed syllabus. Difficulties involved in the general use of these terms are fully appreciated.

In 1942 Miss Gardner published under the title *Testing Results in the Infant School* an account of an investigation in which a comparison was made between attainment and attitudes of children in infant schools which were traditional and those where learning through play was the characteristic feature. A second book, *Long Term Results in Infant School Methods*, published in 1950, followed up children from the two types of infant school into junior schools, most of which were then traditional. In both cases it was found that where children experienced a freer, child-centred education at the infant stage, they were in no way at a disadvantage and in some respects had gained considerably.

Research reported in this book attempted to measure attainments and attitudes of fourth-year pupils in junior schools who had the whole of their education at the infant and junior stages in experimental schools. These pupils were compared with carefully matched controls in schools following a traditional approach. Throughout there is evidence of meticulous care in selecting and matching pupils in terms of age, intelligence, sex and social background. In the selection of the twelve pairs of junior schools involved consideration was given to environment and organisation of ability groups. The study took twelve years and much of the work was carried out by teachers who were students on an advanced course.

The greater part of the book is devoted to a detailed account of tests used and evaluation of results. At the end of the junior school stage pupils in experimental schools were undoubtedly superior in the following tests: listening and remembering; neatness, care and skill; ingenuity; free drawing and painting; English. They also displayed greater effort in following up interests. In about half the control or traditional schools there was superiority in tests of mechanical and problem arithmetic. The care shown in designing the research is evident too in the construction of the wide variety of tests used, many of which will undoubtedly be of value to readers concerned with the study of primary school children.

Miss Gardner refers to changes in primary education since her initial study was started; most infant schools have since adopted experimental methods and there has been some erosion of the traditional approach in junior schools. A transitional stage seems to have been reached, with few

junior schools becoming completely experimental but many accepting some change in this direction. Presenting so adequately an examination of alternative approaches Miss Gardner's book will undoubtedly make a positive contribution to further change.

This kind of long-term detailed study is all too rare and it should inspire others to carry out similar broad-based studies involving teams of researchers. The need is basically twofold: to provide a framework for continuing critical assessment for those who favour experimental methods and to provide evidence of the relative merits of two main approaches, in terms of widely accepted criteria, for teachers favouring traditional methods.

Much is said of freedom of choice in our educational system. Opportunity to exercise this choice is greatly diminished if, in reality, many who favour traditional forms of teaching are unfamiliar with theories and practices associated with experimental education. Too often we persist in educational policies or methods without seriously examining alternatives which may prove more satisfactory. An outstanding example is that of streaming by ability in primary schools. More than thirty years elapsed after the Hadow Report of 1931 recommended streaming before a large-scale investigation, still taking place, was initiated.

This book is of interest to all involved in primary education, whether as students, teachers, lecturers or administrators. The research findings and conclusions are clearly presented; a discussion of underlying theories is, however, not attempted. It is vital that the experimental approach should be seen not only in terms of methods. The practice, if adopted, should be based on an understanding of the development of concepts and of ways in which learning through discovery and experience are more satisfactory than formal methods.

M. STANTON

M. ROBINSON (ed.), *A Basic Science Course for Secondary Schools* (Longmans Green & Co. Ltd., pp. 222, paperback 13s. 6d.).

THIS book is an attempt to design a course covering the requirements of the first three years of science in secondary schools and assumes a time allocation of about three periods per week. In each year, the separate Sciences, Physics, Chemistry and Biology are allocated ten topics and each topic needs a minimum of one week's work. It is in the organisation of each topic where the originality of the book becomes evident and it is for this reason that the book deserves to be seen by all teachers of Science at this level. All the topics are broken down into sections labelled Teacher, Demonstration, Pupil and Class Practical. By means of a simple reference system, the reader can follow the course which a given topic might take and the suggested relationship between the activities of the teacher and the pupils can be seen. Ideas are given for following up the topic and there are appendices on patterns and leads out of the ninety topics, safety notes,

useful films, sources of apparatus and book list. There is also an index.

Since the choice of topics and the arrangement of the work within each topic are likely to lead to discussion and debate amongst science teachers, it is pointless to introduce controversy here. The book has a strong emphasis on methods of teaching and it could be most useful to the young teacher who is finding his way. More experienced ones can also profit by comparing, as an exercise, the methods suggested in this book with their own method of approaching the same topic and it would be rare for the reader not to find something useful or interesting. Nevertheless, the book should be read most carefully and critically for in its present form some methods suggested are open to question. Diagrams could be improved in many instances and there are a few cases where they are incorrect or where precautions from the text to the appendix would be helpful. It is not absolutely clear whether the book is intended for use in class sets. The emphasis seems to be on method rather than on content and though some of the latter is given using diagrams and notes, it is inadequate by itself as a pupil text. Some instructions for class practicals seem to be directed to the pupil whilst others are to the teacher.

Although there appears to be a certain amount of tidying up still to be done in this book, it is worth looking into if only as a means of exchanging ideas. However, it would be deplorable if this book came to be used only as an instruction manual for a basic science course.

C. V. PLATTS

INFORMATION FOR CONTRIBUTORS

The *Educational Review* publishes three times a year general articles and accounts of research of interest to teachers, to lecturers, to research workers in education and educational psychology and to students of education. Articles dealing with research, with descriptions of experimental work in schools, with critical reviews of teaching methods or curricular content in schools will receive special consideration. In addition, the Editors will accept from time to time articles on administrative problems, on tests and measurement, on child growth and development and on the relation of schools to the community.

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